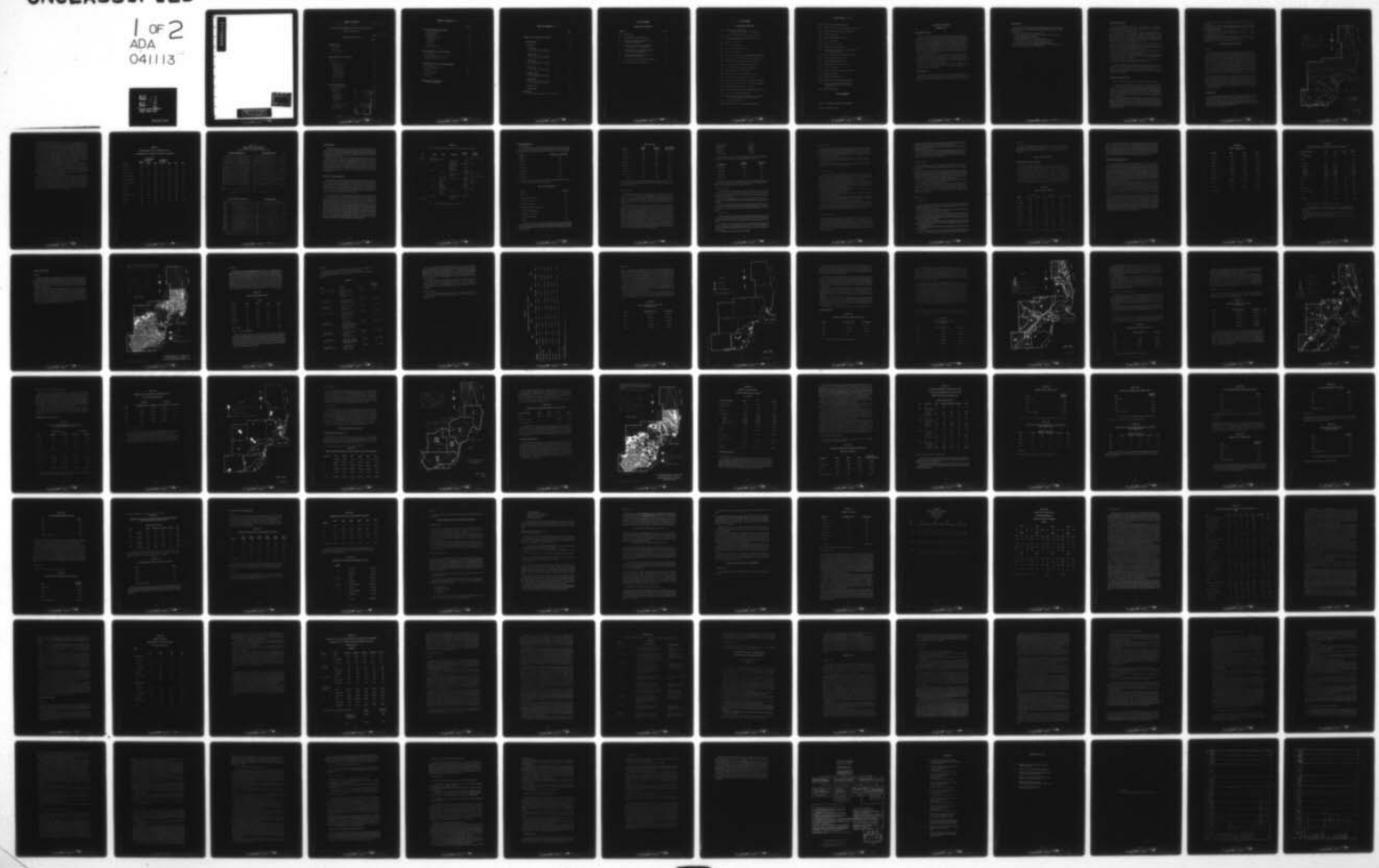
AD-A041 113 CORPS OF ENGINEERS DETROIT MICH DETROIT DISTRICT F/G 13/2
SOUTHEASTERN MICHIGAN WASTEWATER MANAGEMENT SURVEY SCOPE STUDY.--ETC(U)
MAY 74

UNCLASSIFIED NL

1 OF 2
ADA
041113



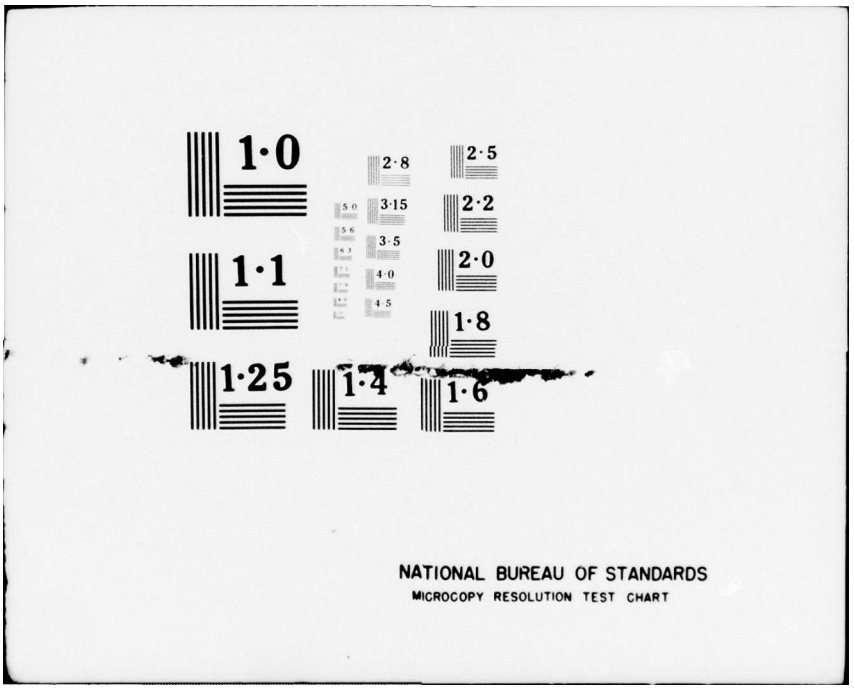

1·0
2·8
2·5
3·15
2·2
3·5
1·1
2·0
4·0
1·8
1·25
1·4
1·6
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

TABLE OF CONTENTS

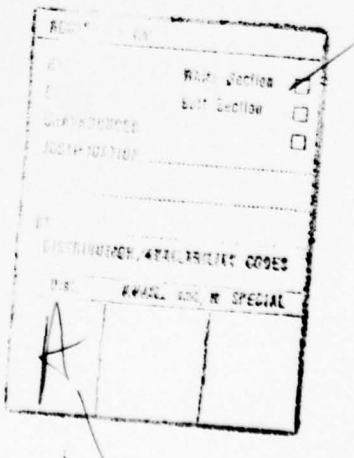
(9) Final rept. (11) May 74

(6) SOUTHEASTERN MICHIGAN WASTEWATER MANAGEMENT

SURVEY SCOPE STUDY

(12) 214 p.

BACKGROUND APPENDIX



410244

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

BACKGROUND APPENDIX

LIST OF TABLES

BACKGROUND APPENDIX

LIST OF TABLES (continued)

LIST OF EXHIBITS

BACKGROUND APPENDIX

INTRODUCTION

NEED FOR THE STUDY

In the past, water resource development by the United States Army Corps of Engineers has concentrated on water supply, recreation, navigation, flood control and shore protection with the assumption that water quality standards would be met through other ongoing programs. Current Federal assistance in improving water quality tends to encourage local governments to develop localized solutions to local problems. This quite often results in a piecemeal application of currently known techniques which fail to solve all water quality problems in an area and do not necessarily use Federal, State and local funds to the best advantage. The current wastewater management program in Michigan is geared to treating wastewater in order to satisfy existing standards. Little recognition is made of wastewater as a valuable resource that can be treated and reused to benefit the environment.

The Southeastern Michigan area is the largest single source of municipal and industrial wastewater flows into Lake Erie, as identified in the 1968 "Lake Erie Report" by the Federal Water Pollution Control Administration. In addition, there are significant overflows each year from combined sewer areas and from most separate sewer areas which discharge stormwater flows directly to receiving streams without treatment.

There is a need for emphasis in the development of a long-range regional program which will balance the many complex variables of the environment with the variables of social well-being and economic development.

STUDY OBJECTIVE

The objective of this Survey Scope Study is to identify the present and future water pollution problems of the Southeastern Michigan study area and to design and evaluate the feasibility and consequences of alternative wastewater management programs in solving these problems. This appendix supplies background information.

STUDY SCOPE

This Survey Scope Study attempts to assure that all wastewater management programs consider the economic, social, institutional, and environmental impacts in conjunction with the technical aspects.

Five basic tasks will be addressed in this study. They are to:

a. Identify and define the nature of the wastewater problem in the 1990-2020 time period.

b. Assess the magnitude of the problem.

c. Develop alternative wastewater management programs.

d. Evaluate effects of alternative wastewater management programs.

e. Assess impacts of alternative wastewater management programs.

The results of this survey scope study are published in this report. The detailed supporting data with analysis is presented in the appropriate appendices.

USE OF STUDY RESULTS

The Survey Scope Study is the second step of a two step procedure to develop a Regional wastewater management program. The Feasibility Study, the first step, was completed in July 1971. The major results of that report were that:

a. Further investigation of water treatment of effluents as a wastewater management alternative; including study of technical design and evaluation of ecological, hygienic, social, aesthetic and economic effects, is necessitated by current political and economic realities and the magnitude of past and current investments in water disposal system. Consideration should be given to the full range of emerging treatment technologies including advanced physical-chemical processes and biological processes.

b. Further investigation of land treatment; including study of technical design and evaluation of ecological, hygienic, social, aesthetic, and economic effects, as a total management approach for wastewater treatment and disposal is warranted by the preliminary indication of significant ecological advantages to this approach.

c. Further investigation of combinations of treatment techniques for a regional program is warranted by political, economic, and institutional realities.

d. Storm water runoff in Southeastern Michigan is of sufficient magnitude to warrant consideration of a collection system large enough to minimize the overflow risk regardless of the wastewater treatment process adopted.

e. Further investigation of a full range of institutional, social and aesthetic effects of large-scale treatment operations, both land and water is needed.

The Survey Scope Study or second step, with the Feasibility Study as a guideline, focuses on the alternatives which seemed best suited for the Southeastern Michigan Region with major emphasis on the Detroit metropolitan area. The Survey Scope Study offers selections of the most promising technological alternatives, compares them and converts them into a regional wastewater management plan.

AUTHORITY FOR THE STUDY

This report is submitted in partial response to the following study authorizations:

a. "Flood Control Act of 1965 (Public Law 89-298 approved 27 October 1965) Section 206.

(a) That the Secretary of the Army is hereby authorized and directed to prepare under the direction of the Chief of Engineers, a comprehensive plan for the development and efficient utilization of the water and related resources of the region drained by streams which discharge, within the State of Michigan, into the Saint Clair River, Lake Saint Clair, the Detroit River and Lake Erie. Such a plan may provide for importation of water from points not located within the region as defined above.

(b) Said comprehensive plan shall be designed to meet the long-range needs of the region for protection against floods, wise use of flood plain lands, improvement of navigation facilities, water supplies for industrial and municipal purposes, outdoor recreational facilities, the enhancement and control of water quality, related purposes, all with a view to encouraging and supporting the optimum long-range economic development of the region and enhancing the welfare of its people."

b. "River and Harbor Act of 1966 (Public Law 89-789 approved 7 November 1966) Section 102.

The Secretary of the Army is hereby authorized and directed to cause surveys to be made at the following named localities and subject to all applicable provisions of Section 110 of the River and Harbor Act of 1950:

...Great Lakes, particularly Lake Ontario and Lake Erie, in connection with water supply, pollution abatement, navigation, flood control, hydroelectric power, and related water resources development and control..."

In regard to the future authority, the Federal Water Control Act (Public Law 92-500 enacted October 1972) places added emphasis on water pollution control and wastewater treatment plans for the Great Lakes than previous study authorizations.

GEOGRAPHY OF THE STUDY AREA

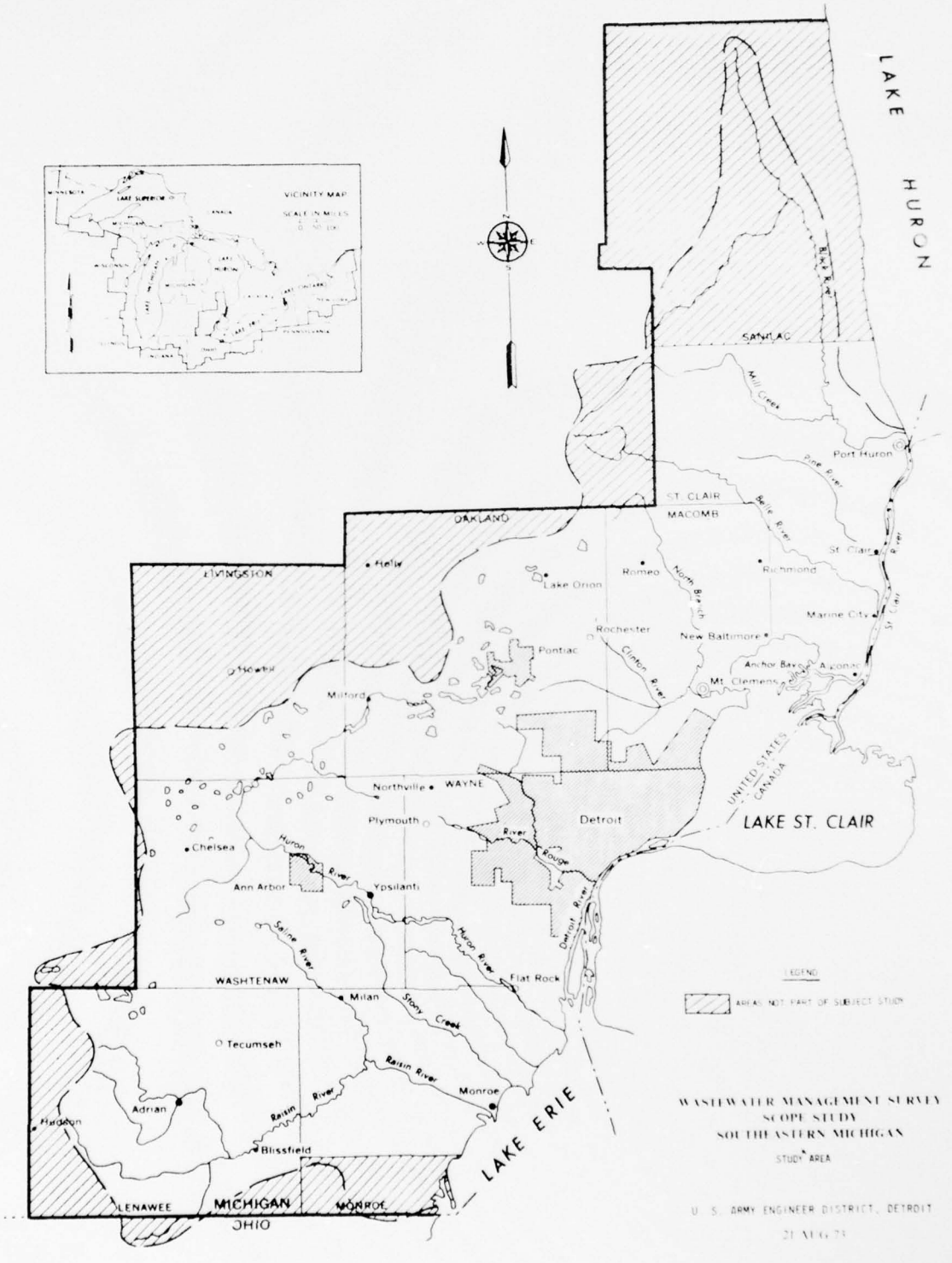
GENERAL

The Southeastern Michigan region consists of a mixture of highly urbanized, suburban, and outlying agricultural area. The study area within this general region includes all of St. Clair, Macomb, Wayne, and Washtenaw Counties, three-quarters of Oakland, Lenawee and Monroe Counties, and one-third of Livingston County, (Figure B-1). This study area generally coincides with River Basin Group 4.1 as defined in the Great Lakes Basin Framework Study with the exception that Sanilac County and outer portions of Oakland, Livingston and Lenawee Counties were omitted. This was done because these areas were outside the basin boundary or separated from urban centers and were expected to retain their rural character at least through 1990. It is anticipated that these areas would eventually become part of the regional system because of their physical connection with and or proximity to the Southeastern Michigan river basins. The townships of Whiteford, Bedford, and Erie in Monroe County were also deleted from the study area because of both their economic and demographic orientation to Toledo, Ohio.

The Southeastern Michigan area is characterized physiographically by seven major river basins which represent a total drainage area of 5,372 square miles. These River Basins are the Black, Pine, Belle, Clinton, Rouge, Huron, and Raisin River basins. Major cities within the study area, and their 1970 populations, are: Detroit (and its suburban complex), 4,161,660; Port Huron, 35,530; Mount Clemens, 20,129; Pontiac, 84,951; Ann Arbor, 98,414; Ypsilanti, 29,260; Adrian, 19,892; and Monroe, 23,623. The total population of the area is approximately four and one-half million.

CLIMATOLOGY

Climate in Southeast Michigan is moderated by the stabilizing influence of the Great Lakes. Prevailing westerly winds passing over Lake Michigan subdue the extremes in temperature, and result in fewer days with temperatures below zero or above 100 F. Climatological data compiled at Detroit indicates a mean annual temperature of about 49.1 degrees in July to a low of 25.3 degrees in January. Temperature extremes have varied from 105 degrees (July 1934) to -24 degrees (December 1872).



WASTEWATER MANAGEMENT SURVEY
SCOPE STUDY
SOUTHEASTERN MICHIGAN

U. S. ARMY ENGINEER DISTRICT, DETROIT

FIGURE B-1

In general, the annual precipitation does not vary greatly over Southeast Michigan. The average annual precipitation over the study area varies from 28.17 inches at Mount Clemens to about 33.69 inches at Adrian. Precipitation is usually ample for the growth and development of vegetation, averaging 31 inches annually over the area with less than 25% of the total as runoff. Total annual snowfall averages vary from 42 inches at Port Huron to 29 inches at Monroe. Long term records for this area show that precipitation is evenly distributed throughout the year, varying from about 2 inches in January to slightly over 3 inches in June. A climatological data summary for the U.S. Weather Bureau stations located within Southeast Michigan is presented in Table B-1. Summaries of average temperatures, total precipitation, total heating degree days and total snowfall for the Detroit City Airport Station, which are considered to be representative for the Southeast Michigan region are presented as Table B-2.

The basic source for long term precipitation data is the United States Department of Commerce Weather Bureau Technical Paper Series, in particular Nos. 2, 25, 29, 40 and 49.

In 1960, the Detroit Metropolitan Area Regional Planning Commission (presently, the Southeast Michigan Council of Governments) recognizing the need for more detailed rainfall information within the major urban areas, established a network of some 61 rain gages in Oakland, Macomb and Wayne Counties in Southeastern Michigan. This network today comprises 76 gauges and extends into Washtenaw County.

An analysis of the limited data currently available for these gages has shown that summer storms, particularly heavy thunderstorms, have produced unusually heavy amounts of precipitation in local areas in a relatively short period of time. It is suggested that a combination of factors may contribute to the development of, and the primary location for the unusually intense air mass type thunderstorms observed in the Detroit Metropolitan suburban area. Many feel that urban air pollution provides a greater than normal supply of precipitation nuclei which may significantly increase rainfall. Also, the heat island effect of metropolitan areas may enhance convective activity and in turn increase precipitation.

TABLE B-1

CLIMATOLOGICAL DATA SUMMARY FOR U. S.

WEATHER BUREAU STATIONS IN SOUTHEAST MICHIGAN

Station	Elevation M.S.L.	Average Annual Precipitation Year of Record	Inches	Temperature of Year of Mean Record	Annual	Max.	Min.
Port Huron	600'	83	30.25	83	46.7	104	-25
Mt. Clemens	577	61	28.17	61	48.0	106	-24
Grosse Pt. Farms	613	14	31.94	13	50.3	100	- 7
Detroit City AP.	623	94	31.49	94	49.1	105	-24
Detroit Metro AP.	633	14	31.51	15	49.6	100	-13
Pontiac State Hosp.	974	63	29.85	71	47.5	104	-22
Milford	1188	30	33.09	30	47.2	104	-20
Ann Arbor	871	81	30.95	80	48.8	105	-21
Adrian	754	83	33.69	83	48.8	108	-26
Monroe Water Wks.	582	44	30.77	44	50.2	106	-21
Dearborn	596	17	27.74	17	50.9	99	- 8
Willis	660	40	30.70	40	48.6	105	-19
Yale	819	43	29.77	--	--	--	--

TABLE B-2

LOCAL CLIMATOLOGICAL DATA FOR DETROIT CITY AIRPORT STATION
(Reprint of U.S. Weather Bureau Publication)

AVERAGE TEMPERATURE

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1930	22.8	33.8	34.4	47.6	61.0	70.5	74.6	73.5	66.2	51.6	42.0	29.6	50.6
1931	28.4	32.8	34.0	48.6	58.4	69.6	77.6	73.2	69.8	57.5	47.8	37.2	52.9
1932	36.7	33.0	29.8	44.3	59.6	70.3	73.0	73.7	64.8	52.9	37.2	29.5	50.4
1933	34.7	27.4	34.0	47.3	60.2	74.6	75.4	72.0	68.5	52.2	36.0	29.8	51.0
1934	30.0	14.8	29.2	44.1	61.6	73.2	75.6	69.2	66.4	52.2	43.6	26.0	48.8
1935	24.8	24.4	39.2	44.4	52.6	64.6	76.2	71.6	61.9	51.4	39.9	25.0	48.0
1936	21.6	16.0	37.6	42.3	62.8	65.8	74.7	73.1	66.2	51.2	35.4	32.2	48.2
1937	29.7	28.2	31.0	44.8	57.9	67.1	72.8	74.0	61.8	48.8	38.4	26.4	48.4
1938	24.3	31.2	41.6	48.2	58.4	67.6	74.0	74.8	61.8	55.0	42.6	30.2	50.8
1939	27.8	26.9	33.5	44.2	61.4	70.2	73.4	73.0	65.9	52.9	38.9	33.4	50.1
1940	19.0	26.7	28.6	47.8	55.7	67.6	73.4	70.4	62.8	52.2	38.0	32.0	47.4
1941	26.2	25.3	30.4	52.6	62.4	70.0	74.4	71.0	67.6	55.2	43.0	35.6	51.1
1942	25.8	22.6	38.5	52.9	59.5	69.0	73.6	70.6	62.6	53.4	41.2	25.6	49.6
1943	21.6	28.0	33.8	42.4	56.6	72.8	73.5	72.2	61.2	50.7	38.2	27.4	48.2
1944	30.8	28.6	31.2	42.9	63.3	71.5	73.6	74.4	65.6	52.8	42.6	24.8	50.2
1945	17.8	27.8	47.9	50.0	52.6	65.3	70.8	71.5	64.7	51.0	41.8	24.7	48.8
1946	28.1	26.6	46.0	47.8	56.6	67.4	73.3	68.4	65.2	58.2	43.9	32.2	51.1
1947	29.3	22.5	30.8	44.7	53.8	66.0	70.8	76.6	65.4	60.3	37.2	29.0	48.9
1948	19.6	24.4	34.8	51.2	55.5	67.3	73.7	72.1	66.1	50.1	45.6	31.7	49.3
1949	31.6	30.7	35.7	47.2	60.4	73.3	76.2	71.9	59.6	57.4	39.0	33.0	51.3
1950	32.6	26.5	30.2	41.5	58.3	68.2	71.1	70.2	63.1	56.4	36.7	25.4	48.4
1951	27.8	27.7	36.5	46.0	59.9	67.8	72.7	69.5	62.5	55.4	34.6	28.4	49.1
1952	29.3	29.3	34.3	49.6	57.3	72.7	76.5	71.5	64.8	48.1	42.8	34.1	50.9
1953	30.6	32.2	37.9	44.5	59.5	70.9	73.5	74.3	64.7	56.8	44.5	33.7	51.9
1954	26.1	33.5	33.5	50.2	54.7	71.3	71.8	70.3	65.6	54.5	41.2	29.7	50.2
1955	26.3	38.4	35.7	54.5	61.9	68.5	79.1	75.7	65.7	55.3	37.7	27.3	51.3
1956	26.4	28.1	32.4	45.7	56.0	69.8	71.8	71.2	60.4	57.5	40.9	34.9	49.6
1957	21.1	30.6	36.9	49.1	56.4	68.7	72.8	70.2	62.9	50.8	41.0	34.1	49.5
1958	26.6	22.8	36.4	49.6	58.1	63.9	72.4	71.0	63.8	55.0	42.9	22.4	48.8
1959	21.3	25.7	34.3	48.6	62.2	70.1	74.1	76.3	67.0	51.9	36.6	34.7	50.2
1960	29.0	27.5	26.3	50.6	58.4	66.9	70.8	71.9	66.9	53.2	43.6	25.2	49.2
1961	23.1	30.8	39.1	43.5	55.8	67.9	73.4	72.2	68.8	56.3	41.3	29.0	50.1
1962	22.3	23.5	35.0	49.6	65.2	69.1	71.0	71.0	61.4	54.6	40.3	25.1	49.0
1963	17.2	18.8	37.6	49.4	57.8	70.8	74.5	70.1	63.1	62.7	46.0	23.8	49.3
1964	30.4	28.9	38.1	49.3	63.7	69.6	76.0	69.1	64.4	51.4	44.9	30.4	51.2
1965	25.5	26.6	30.1	44.9	63.1	67.8	70.4	70.0	66.2	51.3	42.7	35.9	49.6
RECORD MEAN													
TEMP	25.3	25.8	34.4	46.5	58.1	68.0	72.9	70.9	64.1	52.9	40.0	29.4	49.1
MAX	31.6	32.6	41.9	55.4	67.7	77.4	82.3	80.0	73.0	61.2	46.4	35.1	57.1
MIN	18.9	18.9	26.8	37.6	48.5	58.6	63.5	61.8	55.2	44.6	33.5	23.6	41.0

TOTAL PRECIPITATION

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1930	3.85	1.67	1.98	3.60	3.15	2.70	0.50	[illegible]	2.97	[illegible]	1.72	[illegible]	[illegible]
1931	1.68	1.40	2.67	1.37	2.32	2.27	1.81	0.84	2.97	2.43	3.56	2.66	26.46
1932	5.02	1.81	2.15	2.08	5.42	1.35	3.11	4.02	4.05	3.78	1.72	3.57	[illegible]
1933	1.16	1.49	2.25	2.61	3.29	1.19	2.47	2.24	1.94	1.45	1.68	1.38	23.17
1934	1.65	0.47	2.89	2.79	0.58	1.39	1.64	1.84	2.90	1.33	1.67	2.43	21.58
1935	2.33	1.75	1.85	2.39	3.61	4.00	3.57	3.10	[illegible]	[illegible]	3.43	1.66	30.30
1936	1.48	2.62	1.28	3.61	0.97	3.07	0.81	1.07	5.90	2.33	1.10	2.04	27.08
1937	3.64	1.64	0.59	5.03	3.07	4.14	7.03	2.51	1.80	2.35	0.97	1.70	34.47
1938	0.87	4.95	4.40	1.86	4.42	2.28	4.26	2.48	1.51	0.94	1.22	[illegible]	30.73
1939	2.54	4.70	2.38	4.04	0.97	4.70	2.54	1.39	2.70	[illegible]	0.57	[illegible]	[illegible]
1940	1.41	1.29	2.07	2.61	3.59	3.27	1.17	7.51	1.23	[illegible]	2.75	2.98	[illegible]
1941	1.46	0.55	1.59	1.55	2.29	2.94	2.14	3.94	0.81	3.09	1.78	1.31	23.45
1942	2.03	1.60	2.38	1.45	4.51	2.31	3.35	4.12	2.95	4.00	2.92	3.42	35.04
1943	2.25	1.52	2.18	4.11	8.05	1.65	6.01	1.17	[illegible]	1.30	2.07	0.43	33.04
1944	1.20	1.82	2.85	2.62	4.34	3.26	1.20	2.33	1.33	0.73	1.63	1.34	[illegible]
1945	0.45	1.89	3.50	1.37	6.11	4.47	3.18	1.54	4.40	3.14	1.27	2.08	35.40
1946	1.14	1.79	2.14	0.74	5.08	4.01	1.10	2.01	1.65	2.27	[illegible]	2.10	25.39
1947	2.63	0.38	2.45	6.89	6.97	3.49	2.42	2.85	3.96	1.31	1.80	1.85	[illegible]
1948	1.39	2.36	3.32	2.64	4.96	2.79	2.27	2.05	1.29	1.34	4.14	[illegible]	[illegible]
1949	2.74	2.68	2.60	2.03	3.96	1.85	4.85	4.40	1.90	5.50	1.23	3.51	[illegible]
1950	4.38	4.85	2.56	4.92	2.97	2.08	3.90	1.51	2.21	3.56	4.05	2.47	[illegible]
1951	1.91	3.13	2.60	2.71	3.30	3.13	4.10	2.99	1.97	4.96	3.48	3.50	37.78
1952	3.22	1.60	3.25	3.45	2.87	1.06	3.14	2.18	2.30	1.46	2.87	1.94	29.34
1953	1.90	0.82	2.96	3.32	2.99	3.09	2.65	1.52	1.80	0.63	0.63	1.35	23.86
1954	1.68	3.48	3.87	2.71	1.39	2.97	2.01	2.07	2.38	7.80	1.41	1.72	33.49
1955	1.69	2.49	2.11	2.00	1.16	1.87	1.10	3.75	1.82	4.45	2.38	1.41	[illegible]
1956	1.09	2.29	3.57	3.78	6.03	1.61	1.20	6.53	0.58	0.61	3.32	2.19	32.80
1957	1.99	1.85	1.76	4.44	2.97	3.23	5.98	1.99	2.91	4.83	3.28	4.60	39.83
1958	0.80	0.67	0.47	1.69	1.16	2.98	3.01	2.25	3.83	1.11	3.17	0.59	21.73
1959	2.81	2.24	2.65	4.73	3.62	1.01	1.77	7.07	4.69	4.61	[illegible]	2.86	[illegible]
1960	3.06	2.29	1.13	2.06	2.87	6.58	1.44	2.50	0.78	2.17	1.35	0.44	26.67
1961	0.23	2.20	2.68	5.23	2.54	2.74	2.99	5.12	5.55	1.49	2.96	1.29	35.92
1962	2.39	2.55	1.14	2.26	1.26	4.93	2.60	3.56	2.99	[illegible]	1.30	[illegible]	[illegible]
1963	0.64	0.70	2.47	2.25	2.28	3.10	2.91	1.71	1.28	0.51	1.27	1.37	[illegible]
1964	2.26	0.52	2.62	4.65	1.88	2.35	2.37	5.87	2.12	0.50	0.81	2.19	[illegible]
1965	3.74	2.49	3.02	3.04	2.16	2.11	2.99	3.24	4.15	2.88	1.20	3.93	34.95
RECORD MEAN	2.09	2.09	2.45	2.71	3.28	3.30	3.10	2.84	2.69	2.41	2.30	2.21	[illegible]

Record mean values above (not adjusted for instrument location changes listed in the Station Location table) are means for the period beginning in 1874 for temperature and 1871 for precipitation.

TOTAL HEATING DEGREE DAYS

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1929-1930	10	26	114	420	842	1172	1307	875	948	525	195	36	6470
1930-1931	10	2	57	423	692	1094	1135	898	959	490	241	49	6050
1931-1932	0	2	44	267	515	862	874	929	1090	622	209	17	5431
1932-1933	2	2	83	376	833	1100	941	1055	956	531	194	29	6105
1933-1934	1	2	63	398	871	1095	1084	1404	1104	628	179	4	6833
1934-1935	0	46	76	398	639	1211	1247	1136	802	618	394	82	6649
1935-1936	0	32	144	425	749	1240	1342	1420	849	678	166	59	7104
1936-1937	6	7	105	429	886	1012	1094	1031	1051	607	243	37	6508
1937-1938	14	0	178	519	798	1196	1262	944	729	512	220	32	[illegible]
1938-1939	0	1	139	329	668	1077	1153	1068	976	625	185	26	6247
1939-1940	5	0	108	399	788	980	1431	1110	1128	662	301	40	6952
1940-1941	23	41	131	407	805	1021	[illegible]	1111	1068	393	176	33	6415
1941-1942	2	17	61	329	661	912	1213	1185	820	401	226	35	5862
1942-1943	4	12	188	365	[illegible]	1223	1342	1034	967	[illegible]	275	[illegible]	6840
1943-1944	1	12	171	447	804	1165	1063	1053	1050	[illegible]	144	28	6603
1944-1945	0	10	91	349	673	1250	1465	1046	534	448	397	116	[illegible]
1945-1946	18	11	109	433	699	1250	1141	1077	589	517	273	88	[illegible]
1946-1947	1	37	85	228	632	1019	1105	1192	1058	609	352	87	[illegible]
1947-1948	16	5	150	178	835	1117	1408	1178	932	426	298	52	6595
1948-1949	0	4	74	462	580	1032	1035	962	909	534	209	31	5832
1949-1950	3	13	182	270	782	993	997	1070	1070	696	211	[illegible]	[illegible]
1950-1951	9	16	106	284	849	1218	1148	1038	878	562	197	32	[illegible]
1951-1952	1	14	116	332	902	1126	1098	1031	945	463	235	14	6277
1952-1953	2	11	95	521	680	953	1062	913	834	607	188	15	[illegible]
1953-1954	5	1	102	264	609	984	1200	874	967	442	327	[illegible]	5801
1954-1955	10	5	71	350	705	1088	1196	1018	900	311	154	27	5835
1955-1956	0	2	80	304	811	1165	1190	1061	1003	573	310	61	6580
1956-1957	0	11	172	240	716	929	1355	958	867	497	281	52	6078
1957-1958	0	7	130	432	713	952	1182	1173	883	457	228	76	6233
1958-1959	1	8	98	323	657	1313	1349	1093	945	486	159	34	6466
1959-1960	0	0	92	408	845	933	1110	1081	1198	446	219	43	6373
1960-1961	4	0	[illegible]	368	636	1229	1291	950	795	638	295	47	6306
1961-1962	4	2	64	278	705	1108	1318	1157	922	486	134	26	6202
1962-1963	1	0	162	327	731	1228	1475	1287	838	470	245	26	6288
1963-1964	2	9	100	131	582	1269	1088	1040	886	469	113	52	5699
1964-1965	0	25	110	411	594	1066	1215	1070	1078	596	121	45	6331
1965-1966	10	24	85	419	663	894							

TOTAL SNOWFALL

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1929-1930	.0	.0	.0	T	1.4	27.4	[illegible]	6.2	24.6	0.4	.0	.0	66.5
1930-1931	.0	.0	.0	1.4	3.1	9.1	14.3	3.5	14.3	2.1	.0	.0	47.8
1931-1932	.0	.0	.0	.0	0.7	1.3	0.8	9.5	[illegible]	2.1	.0	.0	26.2
1932-1933	.0	.0	.0	T	10.1	4.0	0.4	4.4	7.0	T	.0	.0	25.9
1933-1934	.0	.0	.0	.0	10.5	6.6	[illegible]	5.1	13.1	1.1	.0	.0	42.6
1934-1935	.0	.0	.0	T	T	12.2	1.4	14.0	4.4	0.2	.0	.0	32.2
1935-1936	.0	.0	.0	T	0.2	8.9	10.1	14.7	1.7	1.2	.0	.0	36.8
1936-1937	.0	.0	.0	0.3	2.0	1.6	4.4	1.8	7.8	T	.0	.0	17.9
1937-1938	.0	.0	.0	T	1.0	[illegible]	4.4	4.8	[illegible]	1.9	[illegible]	[illegible]	[illegible]
1938-1939	.0	.0	.0	.0	2.7	6.1	21.1	10.8	1.4	0.2	.0	.0	[illegible]
1939-1940	.0	.0	.0	T	T	1.9	5.9	11.7	9.3	3.4	T	.0	32.2
1940-1941	.0	.0	.0	.0	9.1	4.3	6.4	4.2	2.8	.0	.0	.0	[illegible]
1941-1942	.0	.0	.0	.0	0.5	3.4	3.3	9.3	2.2	4.7	.0	.0	23.4
1942-1943	.0	.0	.0	T	4.4	9.2	18.4	2.7	2.9	6.8	.0	.0	44.4
1943-1944	.0	.0	.0	1.0	3.1	0.9	3.9	11.1	3.9	0.9	.0	.0	22.8
1944-1945	.0	.0	.0	.0	T	11.8	5.8	7.7	0.3	0.2	T	.0	25.8
1945-1946	.0	.0	.0	.0	0.1	6.8	[illegible]	8.7	T	.0	.0	.0	22.0
1946-1947	.0	.0	.0	.0	0.3	5.3	[illegible]	4.1	9.4	3.3	T	.0	30.0
1947-1948	.0	.0	.0	.0	3.1	9.4	5.0	[illegible]	4.5	T	.0	.0	[illegible]
1948-1949	.0	.0	.0	.0	T	[illegible]	[illegible]	3.1	2.1	0.3	.0	.0	13.7
1949-1950	.0	.0	.0	.0	5.5	4.7	9.5	13.0	[illegible]	0.5	.0	.0	[illegible]
1950-1951	.0	.0	.0	.0	9.2	6.5	15.4	4.4	6.5	0.2	.0	.0	42.2
1951-1952	.0	.0	.0	T	8.3	24.0	12.0	7.3	7.0	T	.0	.0	[illegible]
1952-1953	.0	.0	.0	T	T	4.3	9.4	0.7	1.0	1.2	.0	.0	[illegible]
1953-1954	.0	.0	.0	.0	3.0	5.0	6.0	10.4	15.5	T	0.1	.0	40.0
1954-1955	.0	.0	.0	T	0.7	6.6	[illegible]	10.9	[illegible]	T	.0	.0	[illegible]
1955-1956	.0	.0	.0	T	4.8	4.8	11.0	10.6	13.3	0.7	.0	.0	45.2
1956-1957	.0	.0	.0	.0	6.2	5.4	17.9	8.9	3.9	2.8	.0	.0	[illegible]
1957-1958	.0	.0	.0	T	1.7	5.1	3.1	4.1	3.5	0.2	.0	.0	18.0
1958-1959	.0	.0	.0	.0	4.5	6.4	15.4	4.3	6.6	T	.0	.0	[illegible]
1959-1960	.0	.0	.0	T	8.1	6.8	6.7	14.8	11.5	T	T	.0	47.7
1960-1961	.0	.0	.0	T	1.0	4.5	3.3	5.1	0.4	3.7	T	.0	18.0
1961-1962	.0	.0	.0	.0	T	5.0	5.0	15.7	2.3	0.1	.0	.0	28.1
1962-1963	.0	.0	.0	T	0.2	11.2	7.5	7.6	3.2	T	T	.0	29.7
1963-1964	.0	.0	.0	.0	T	10.7	6.7	5.1	9.2	1.2	.0	.0	32.5
1964-1965	.0	.0	.0	T	2.6	8.4	7.1	11.8	12.9	2.4	.0	[illegible]	[illegible]
1965-1966	.0	.0	.0	T	0.2	1.6							

A horizontal line drawn on the above tables indicates a break in the data sequence due to a change in instrument exposure or a station move (see Station Location table).

METEOROLOGY[3]

Southeast Michigan is subject to two types of storms. The first type is the large area storms of long duration and moderate intensities and the other type is the short term, thunder storm type rainfall of short duration and high intensities. The longer duration storms occur any time throughout the year, but intense local storms of the thunderstorm type usually occur in the late spring and throughout the summer.

High and low pressure systems tend to move across Southeast Michigan at intervals of 3 to 5 days. These disturbances originate in the North Pacific, Western Canada, or in the Rocky Mountain region and travel at the rate of about 500 miles a day. Low pressure areas do not remain stationary over the State for long periods of time, and precipitation records do not indicate that such conditions have occurred within the record, since the major storms have been limited to a duration of 3 days or less. The major extensive storms of record, that have produced periods of high runoff over large areas, have been cyclonic disturbances similar to those mentioned above.

GEOLOGY AND TOPOGRAPHY[1, 9]

Topography of the study area can generally be divided into two distinct land forms - glacial drift and former lake bed. In the western half, or upstream portions of the major tributaries, rolling to rugged terrain is interspersed locally with relatively flat areas. Numerous inland lakes, interconnected by marshy lands and small streams, are found in the area. The lower lake bed portion of the study area is predominantly level, generally without any natural-formed lakes and is marked by a series of fragmentary ancestral lake beach ridges. From the lake bed region inland, the elevation rises gradually from 600 to 1,000 feet.

The surface geology of Southeast Michigan (Table B-3) is the result of border moraines from the Lake Erie-Huron lobe and the Saginaw lobe during the Wisconsin glacial period and from the ponding of glacial melt water. A mixture of sand, silt, clay and glacial drift characterizes the rolling land in the west half of the area. In the east half, the level land is former lake plain consisting of water worked glacial drift material. The glacial drift is very thin in Monroe County where there are numerous bedrock outcrops, but the glacial drift becomes thicker to the north and west reaching 250 to 300 feet at many points in the southeast Michigan area. The yield of ground water from the glacier drift materials is extremely variable but generally of good chemical quality. Highest yields of water are found in the rolling drift and the lowest yields in the lake plain. The pre-glacial bedrock surface is Silurian in age in eastern Monroe County. Successively younger bedrock formations are found in the northwest direction with a gradual dip into the Michigan geosynclinal basin. Ground water from wells in the bedrock is generally low in quantity and high in dissolved minerals.

TABLE B-3

General stratigraphic succession and mineral resources in southeastern Michigan

Era	System	Group	Formation	Thickness, feet	Mineral Resources
Cenozoic	Quaternary				Sand, gravel, clay, peat
Paleozoic	Pennsylvanian	Saginaw		to 50	
	Mississippian		Michigan Fm.	50-75	
			Marshall Ss.	50-150	
			Coldwater Sh.	1000-1150	Shale
			Sunbury Sh.)		
			Berea Ss.)	50-400	
			Bedford Sh.)		
	Devonian		Antrim Sh.	100-250	
		Traverse		90-690	Oil
			Rogers City Ls.)	35-360	Oil, limestone
			Dundee Ls.)		
		Detroit River		200-900	Gas, limestone, sandstone
			Bois Blanc Fm.	0-6000	
	Silurian	Bass Islands)		400-3000	Dolomite
		Salina)			Salt, oil, gas
		Niagara		100-475	Oil, gas
		Cataract		100-160	
	Ordovician	Richmond		575-825	
		Trenton)		650-900	Oil, gas
		Black River)			Oil, gas
			St. Peter Ss.	0-40	
		Prairie	)		
		du Chien	)		
	Cambrian		Trempealeau Fm.)	200-1800	
			Munising Fm.)		
Precambrian					

Source: Harry J. Hardenberg, Michigan Geological Survey

NATURAL RESOURCES

Water Resources

Seven principal streams traverse the Southeast Michigan area. Data on their drainage areas is presented in the following table. It should be noted that part of the drainage areas of some of these streams fall outside the eight county area covered in this Survey Scope Study.

Stream	Drainage Area (Square Miles)
Black River	746
Belle River	199
Pine River	232
Clinton River	767
Rouge River	455
Huron River	923
Raisin River	1,043

The 7-day, once in 10 year, low flow in cubic-feet per second has been developed for seven U.S. Geological Survey gaging stations on these streams.

7-Day, 10 Year Drought Flows

Station	Flows (cfs)
Black River	NA
Belle River near Memphis	3.5
Clinton River at Mt. Clemens	48.0
River Rouge at Detroit	4.2
Middle River Rouge near Garden City	3.75
Lower River Rouge at Inkster	0.6
Huron River at Ann Arbor	54.0
River Raisin near Monroe	33.5
Pine River	NA

An abundance of natural and artificial lakes constitute one of the Southeast Michigan areas's major assets. Most of the natural lakes are located in the moraine hills and outwash region in the northwestern portion of the area. A county summary of inland lakes is presented in the following table.

Inland Lakes Data

County	# Inland Lakes	Total Lake Acreage	Miles of Inland Lake Shoreline
Lenawee	252	5,496	NA
Livingston	264	7,050	176.0
Macomb	278	1,665	38.4
Monroe	346	1,894	11.2
Oakland	1,534	22,669	486.0
St. Clair	239	575	30.0
Washtenaw	460	8,767	148.0
Wayne	298	2,889	64.8
TOTAL	3,681	51,005	954.4

In addition, the waters and shoreline of the Great Lakes and connecting channels provide additional resources to the Southeast Michigan Area. The area has about 300 miles of Great Lakes and inland shoreline.

Huron River Basin.[9]

The Huron River system drains an area of approximately 923 square miles. The main stream rises in Big Lake, Springfield Township, Oakland County, from which it flows generally southwest. The upper river flows through the Strawberry-Gallagher-Whitewood-Base Line Lake system. Below this lake system, the Huron turns easterly and flows generally southeasterly to Lake Erie, passing through the cities of Dexter, Ann Arbor, Ypsilanti, Belleville, Flat Rock and Rockwood.

A stream gaging station on the Huron River at Ann Arbor has been in operation since 1902. Unfortunately, streamflow data collected prior to 1947 is held to be of questionable validity due to a number of factors. The station was originally located at the Barton Pond Dam and flow measurements were computed based on the amount of water flowing through the turbines of the hydroelectric generating plant. Error sources include: turbine leakage, which varied depending on the degree and frequency of adjustment of the control gates; flow regulation through operation of the dam for power generation purposes; and the lack of verifying turbine efficiency from 1920 to 1940. For these reasons, gaging records from 1949 to 1970 have been used to compute low flows. The calculated 7-day, 10 year low flow for this period is 54 cfs. This low flow figure does not include Ann Arbor's water supply withdrawals.

The Huron River Basin contains some 350 natural and artificial lakes. Totalling nearly 24,000 acres, these lakes comprise about 4 percent of the basin's area. Total lake frontage is conservatively estimated at 320 miles. The five largest lakes are:

Big Portage Lake	645 acres
Belleville Lake	1,270 acres
Kent Lake	1,000 acres
Ford Lake	975 acres
Whitmore Lake	677 acres

In the Ann Arbor area, the City of Ann Arbor maintains four mainstream impoundments which were originally constructed for power generation purposes. These are:

Impoundment	Volume (Acre-Feet)	Surface Area (acres)
Barton Pond	3,600	310
Argo Pond	530	106
Geddes Pond	1,179	292
Superior Pond	625	109

The Huron River serves as a water supply source for Ann Arbor (intake at Barton Pond), Ypsilanti (intake at Geddes Pond), and Flat Rock (intake at the Flat Rock Impoundment). Both Ann Arbor and Ypsilanti also utilize groundwater sources.

The Black River Basin[2]

The Black River Basin has a drainage area of approximately 746 square miles. The Black River rises in the morainal hills at the Huron-Sanilac County line and flows southward with stream tributaries joining from the west. The major tributaries are Elk Creek near Sandusky and Mill Creek near its mouth.

There are various stream gaging stations on the Black and Mill Creeks which can be used to compute low flows. The calculated 7 day, 10 year low flow for the Black River near Fargo is not available.

The Black River Basin contains some 48 lakes and ponds ranging from 120 acres to less than one. No major impoundments for power generation have been utilized, but favorable sites are available. Low flows for long periods of time, however, make usefulness of the stream limited.

Pine River Basin[3]

The Pine River Basin has a drainage area of approximately 232 square miles. The Pine River rises in the morainal hills in the west-central part of St. Clair County. Small tributaries with intermittent flows join its course in a southeasterly direction as it flows into the St. Clair River.

The basin has poor natural drainage. Most run-off is carried by manmade ditches and drains. No stream flow monitoring program is currently active for the Pine River Basin. The basin contains 23 lakes and ponds which range from 5.7 acres to less than 1 acre with only two being over 1 acre.

No impoundments, major or minor, occur in the basin.

The Belle River Basin[4]

The Belle River Basin has a drainage area of approximately 199 square miles. The Belle River rises in the morainal hills near Dryden and flows generally southeast to the St. Clair River. Its basin is narrow with small tributary streams, with many having intermittent flows.

The natural drainage pattern is well defined with drains and ditches used to reclaim agricultural land from swampy areas.

There is a gage site at Memphis for which the low flow 7 Day 10 Year is 3.5 cfs.

The basin contains 61 lakes and ponds of which 43 are less than one acre. The 18 other lakes range from 1 to 65 acres.

There are three impoundments in the basin. Two were used as power sources for mills now abandoned; the other is a control facility for Squire Lake.

The Clinton River Basin[5]

The Clinton River Basin has a drainage area of approximately 767 square miles. The river is formed from a chain of lakes near the northwestern edge of the basin. Near the city of Pontiac the river turns east into a well defined valley, where it is joined by the major tributaries of Galloway, Paint and Stoney Creeks, in the northwestern section of the basin.

In a southwesterly course from Utica to its mouth the river is characterized by low banks, frequent meandors, and oxbows. In the southeastern extermity of the basin, the runoff from urbanized Detroit is directed to the Red Run Drain; in the North and Middle Branches of the Clinton the agricultural lands are drained by ditches.

The flood plains of the Clinton, from Utica and Rochester to Mt. Clemens, have been developed extensively for public recreational use.

There are various stream gages on the Clinton; for example, the 7 Day 10 Year calculated low flow at Mt. Clemens is 48 cfs.

There are about 670 lakes and ponds within the basin. These ponds range from 1,280 acres (Cass Lake) to less than 1 acre. Of the lakes and ponds, 47% are less than 11 acre, 35% are from 1 to 10 acres, 11% are from 10 to 50 acres, and 7% are greater than 50 acres.

There have been 49 hydraulic structures in the Clinton River basin of which 48 were used for power supply of grist mills. The one remaining structure is used for utility power supply. Most of the grist mills have been abandoned or razed. The hydraulic structures remaining are used for recreational and residential lake impoundments and lake level control.

The Raisin River Basin[6]

The Raisin River Basin has a drainage area of approximately 1,043 square miles. The River Raisin begins in the rugged Irish Hills and lake district in the western part of the basin. In the vicinity of Manchester the river turns from its northeasterly course to a south-flowing course in a well defined channel ranging from 30 to 50 feet below the land surface. At Adrian the river leaves the glacial moraine and outwash areas for a generally easterly course in a wide meandering belt. At Dundee the course straightens, with a channel less than 20 feet wide, and flows into Lake Erie.

The Raisin River has numerous tributaries with the major ones being: South Branch River Raisin, Black Creek, Little River Raisin, Macon River and Saline River.

There are various gaging stations along the river. For example the 7 Day, 10 Year low flow calculated near Monroe is 33.5cfs.

The river basin contains 429 lakes and ponds with the following distribution: 31% less than 1 acre, 47% from 1 to 10 acres, 15% from 10 to 50 acres, and 7% greater than 50 acres.

There are 39 hydraulic structures in the basin. Most of these structures are used for lake-level control to provide small ponds for aesthetic use.

The River Rouge Basin[7]

The River Rouge Basin drainage area is approximately 455 square miles. The river begins in the northern part of the basin and flows generally in a southern direction to its mouth at the Detroit River.

The major tributaries, which enter the stream from the north and northwest, are the Upper, Middle, and Lower Rouge Rivers. The basin, through which the tributaries and main branch run, is well developed with major use of the flood plains for development of parks, golf courses and, other related facilities. Flooding, however, has increased in the flood plains due to the encrouchment of urbanization and the lack of adequate zoning ordinances.

There are various gaging stations on the River Rouge. The gage at Detroit was used as the base for calculating the 7 Day, 10 Year low flow of 4.2 cfs.

There are 404 lakes and ponds within the basin with the following distribution: 60% are less than one acre, 27% from 1 to 5 acres, 8% from 5 to 30 acres and 5% more than 30 acres in size.

There are 21 hydraulic structures in the basin, several of which are used for power production. The remainder are used for mill ponds, lake impoundment municipal supply, irrigation and fire protection.

Biological Resources[9, 10]

Water Fowl

Lake Erie, the Detroit River and Lake St. Clair are all important water fowl habitats in Southeastern Michigan. Also, inland water fowl habitats are plentiful in the many marsh, lowlands and fresh water lakes of the area.

The needs of 25 water fowl species present within this area are varied. Most water fowl foods are in an area where water depth is from 0 to 12 feet.

Resting and feeding areas for both spring and fall migrations are in the marsh areas along the lakes and rivers. The Anchor Bay area in Lake St. Clair, the Point Mouille area in lower Detroit River, and the Monroe-Maumee Bay area in western Lake Erie are major resting and feeding sites in Southeastern Michigan.

The Detroit River is also a very important water fowl stopping point with major feeding grounds from Zug Island to Lake Erie. This area is becoming highly polluted and is the source of a diminishing food supply.

The remaining marshes of Lake Erie still attract large numbers of water fowl in the spring and fall migration.

The area at Anchor Bay on Lake St. Clair and lower Detroit River with adjacent waters of Lake Erie serve 16.8 percent of the hunters and 18.6 percent of the bird harvest in the area.

Sport Fishing

Diversity is the main characteristic of sport fishery with over 18 species available in the region. Lake St. Clair supports a heavy concentration of fishermen. However, in the past few years fishing has decreased drastically due to the invasion of mercury pollution into the lake environment.

THE STUDY AREA TODAY

DEMOGRAPHIC CHARACTERISTICS

Southeastern Michigan, like the nation, has experienced expanding urbanization over the past several decades. The three central counties - Macomb, Oakland and Wayne - have served as the hub of this outward growth. Sub-centers of population growth encircle the city of Detroit at varying distances. These include the City of Monroe on the south, Ann Arbor and Ypsilanti on the west; Southfield, Royal Oak and Pontiac to the north; Warren, Sterling Heights, St Clair Shores and Mt. Clemens to the near northeast, and Port Huron still farther northeast.

The population of southeastern Michigan increased 1,411,000 from 1950 to 1970, and accounted for 56% of Michigan's growth of 2,503,000. Due to a decline in the birth rate after 1960 and also due to a levelling of economic growth, the population gain of the southeastern area dropped to about 560,000 from 1960 to 1970, compared to 851,000 the previous decade.

TABLE B-4

POPULATION BY COUNTIES

	1950		1960		1970	
County	**Pop.**	**% Total**	**Pop.**	**% Total**	**Pop.**	**% Total**
Lenawee	64,629	1.9	77,789	1.8	81,951	1.7
Livingston	26,725	0.8	38,233	0.9	58,967	1.2
Macomb	184,961	5.4	405,804	9.4	625,309	12.9
Monroe	75,666	2.3	101,120	2.4	118,479	2.5
Oakland	396,001	11.3	690,259	16.0	907,871	18.7
St. Clair	91,599	2.7	107,201	2.5	120,175	2.5
Sanilac	30,837	0.9	32,314	0.8	34,889	0.7
Washtenaw	134,606	3.9	172,440	4.1	234,103	4.8
Wayne	2,435,235	70.8	2,666,297	62.1	2,669,604	55.0
Totals	3,440,259	100%	4,291,457	100%	4,851,348	100%

Due to decentralized growth of economic enterprises, primarily in manufacturing, retail and service activities, the City of Detroit has decreased in population since 1950. The rest of Wayne County as well as the adjoining counties of Macomb and Oakland have established significant population gains during the two decades since 1950. Only Washtenaw, of the outlying counties, has experienced similar high rates of population increase. The "built-up" capacity of Southeastern Michigan has been estimated as approximately 20.4 million people. The region was 20% built-up in 1960 and approximately 23% built-up by 1970.

ECONOMIC CHARACTERISTICS

The core economic activity of Southeastern Michigan for some decades has been manufacturing, with automotive production as the major component. This industry, which is basic to the manufacturing complex, had its inception in Detroit and has continued to maintain a significant portion of its fabricating and assembly operations within the region. Automotive plants are scattered widely over the region. Other industries are located both along the shoreline and inland. Secondary metal fabricators, food processors and power plants are concentrated in the northeast (St. Clair and Clinton River basins); primary metal production, chemicals and allied products, and power plants are located in the central area (Detroit and Rouge River basins); and secondary metal fabricators, paper products and power plants are situated in the southwest (Huron and Raisin River basins).

From 1950 to 1970 total employment increased 471,933, from 1,343, 172 to 1,815,105. Although manufacturing employment registered a small numerical increase, this sector of the economy declined from 45.8% to 36.8% of the total. During this period, increases in non-manufacturing have been a significant trend for at least 20 years in the Southeastern Michigan area, as well as in other major metropolitan areas. From 1954 to 1967, manufacturing employment grew 64,108; employment in retail, wholesale and selected services mounted 131,430.

Urbanization has been spreading from the central city, Detroit, and from the other urban centers to the surrounding communities and townships. One feature of this movement has been the dispersed pattern of economic establishments, such as, manufacturing plants, shopping centers, office and professional service complexes. The largest portion of this spread of economic activity has been confined to the three central counties of Wayne, Oakland and Macomb, which form the metropolitan statistical area. In 1950, employment in the Detroit Metropolitan Area constitued 88.8% of the total of the nine county economic area. By 1970, it still accounted for 82.3%. The total employment for the area is shown in Table B-5. Total employment by Industry Group is shown in Table B-6.

TABLE B-5

TOTAL EMPLOYMENT

COUNTY	1950	1960	1970
Lenawee	23,554	26,284	20,064
Livingston	9,325	13,200	21,127
Macomb	63,360	133,915	228,429
Monroe	25,512	32,420	41,924
Oakland	146,981	240,861	344,320
St. Clair	32,600	35,039	41,207
Sanilac	10,727	10,930	11,699
Washtenaw	48,110	65,532	97,591
Wayne	983,003	953,959	998,204
TOTAL	1,343,172	1,512,140	1,815,105
Participation	39.04	35.20	37.41

TABLE B-6

AREA EMPLOYMENT BY INDUSTRY GROUPS*, 1950 and 1970

INDUSTRY GROUP	1950	1970	%Total	Change
Agriculture, Forestry and Fishing	30,422	15,265	0.8	- 15,157
Mining	1,147	2,130		983
Construction	65,115	81,074	4.5	15,959
Manufacturing	610,252	667,222	36.8	56,970
Food	22,092	16,804		- 5,288
Textiles	2,305	7,257		4,952
Chemicals	16,721	19,464		2,743
Metals	73,032	91,855		18,823
Transp. Equip.	355,443	299,455		- 55,988
Other	142,915	232,387		89,472
Wholesale	37,681	70,492	3.9	32,811
Retail	200,513	281,524	15.5	81,011
Services	229,133	475,257	28.8	246,124
Professional, etc.	20,571	46,692		26,121
Public Administration	42,774	70,822	3.9	28,048
Other	105,564	104,627	5.8	937
TOTALS	1,343,172	1,815,105	100.0	471,933

* Developed from GLBFS and SEMCOG projections, adjusted.

From the above tables it is evident that the Agriculture, Forestry, and Fishing Group has experienced a 50% decline due to the increased urbanization of cities and pollution of receiving bodies of water.

Another significant 20 year trend is the decline of manufacturing employment as to total employment with a increase toward services and trade.

More information on economic impacts may be found in Economic Assessment Appendix.

NATURAL RESOURCES

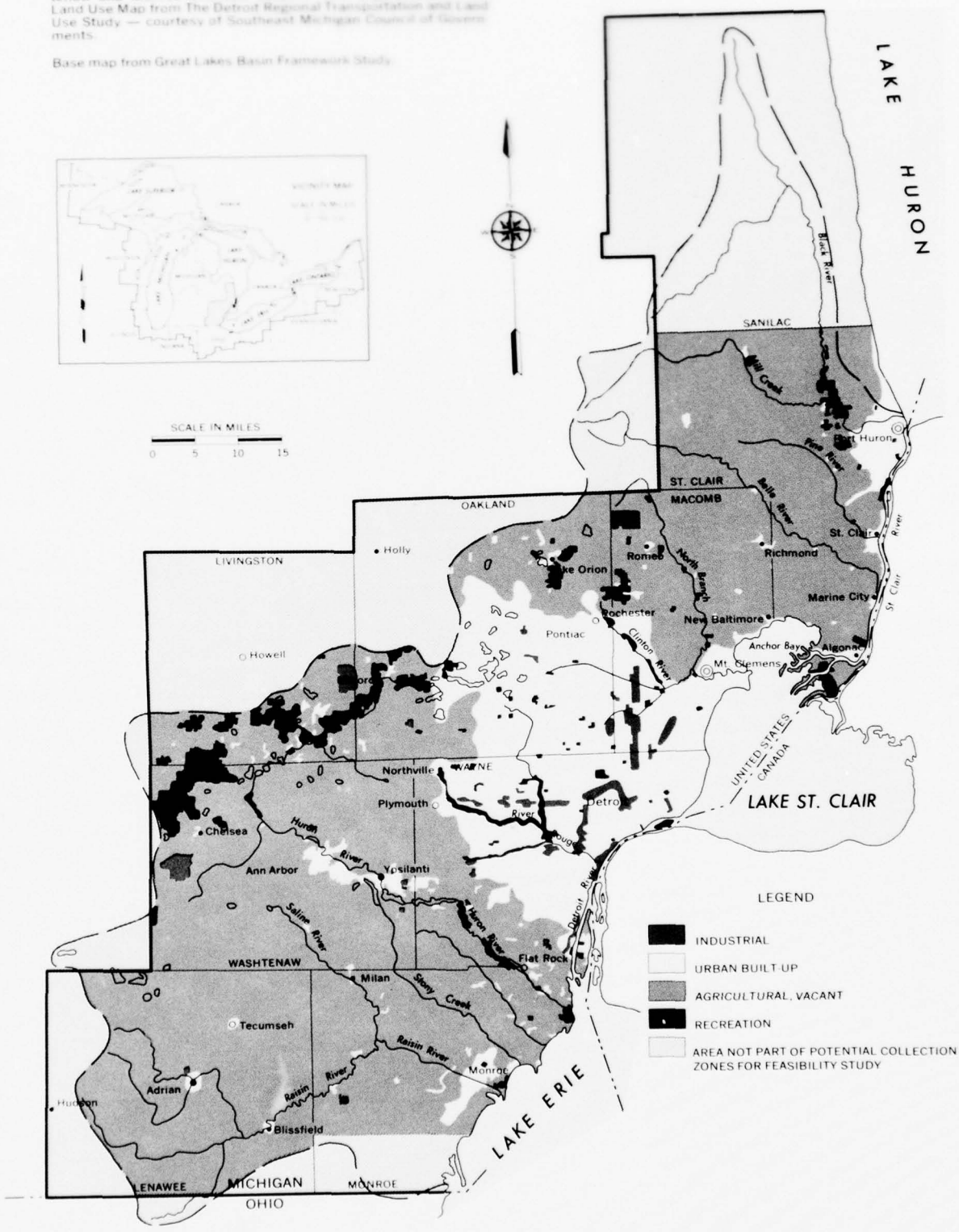
Land Use

Southeastern Michigan is significantly influenced by the character and activities of the metropolitan areas which form parts of this important region. The standard metropolitan statistical area (SMSA) of Detroit composes the three central counties of Wayne, Oakland and Macomb. Washtenaw County, with Ann Arbor as its major city, forms the Ann Arbor metropolitan area. Monroe County, to the south, is included in the Toledo, Ohio, standard metropolitan statistical area.

The map on Figure B-2 depicts the 1965 major land uses within the seven major counties of the region. This land use pattern was surveyed and mapped by the Detroit Regional Transportation and Land Use Study (TALUS), a special project of the Southeast Michigan Council of Governments and its predecessor, the Detroit Metropolitan Area Regional Planning Commission. Industrial corridors, the highway network, major residential areas and regional parks are shown as the predominant land uses. Since 1950, the successive incorporation of over 20 cities and villages, from former township lands that were considered farm or rural, has highlighted the process of spreading urbanization.

Land Use Patterns for St. Clair, Macomb, Oakland, Wayne, Washtenaw, and Monroe Counties adapted from a generalized 1965 Land Use Map from The Detroit Regional Transportation and Land Use Study — courtesy of Southeast Michigan Council of Governments.

Base map from Great Lakes Basin Framework Study



Wastewater Management Feasibility Study
Southeast Michigan — Lake Erie
GENERALIZED LAND USE PATTERN — 1965

U.S. Army Corps of Engineers, Detroit District.

Agricultural

As might be expected from increased urbanization, the farm and rural populations have experienced marked declines in their numbers. The latest census figures (1970) show that only Monroe County with some 53 percent and St. Clair County with 48 percent rural populations still have significant rural characteristics. Persons living on farms in 1960 in Southeast Michigan had declined nearly 50 percent since 1950. This reduction in farm numbers and population reflects the consolidation of farming units, decreasing farm family size and changing farm definitions. Even though the value of farm products produced in the southeast Michigan region has continued to rise, the percent of land in farms has diminished. As late as 1954, some 59 percent of the six county area was in farms, but by 1967 only 40 percent remained in farmland. Table B-7 shows the county and regional percentages of total land areas in farms.

TABLE B-7

PERCENT OF LAND IN FARMS

	YEAR			
County	**1954**	**1959**	**1964**	**1967**
Macomb	56%	49%	44%	38%
Monroe	80%	78%	73%	64%
Oakland	42%	29%	23%	18%
St. Clair	74%	65%	59%	51%
Washtenaw	76%	70%	65%	54%
Wayne	25%	22%	17%	14%
Regional Totals	59%	52%	47%	40%

Source: U.S. Census of Agriculture.

Major crops grown in the area are corn, grain, soybeans, and alfalfa. In addition to cropland, the southeast Michigan river basins contain approximately 17 percent of their land in forests, estimated at 665,700 acres. Total forest land has decreased about 2 percent from 1955 to 1966. Oakland County has the greatest concentration with 28 percent, while Monroe and Wayne Counties have the least with 10 percent each. As the need for more recreation land and land for urban expansion increases, forest land for wood products will give way to multiple use for recreation, aesthetics and municipal parks.

Recreational

In the Southeastern Michigan area the Huron-Clinton Metropolitan Authority is the major regional agency which provides to the public recreational facilities.

The following table illustrates the name of the Park, Location and Size for Southeastern Michigan.

TABLE B-8

Name	Location	Size	Recreation Available
Kensington Metropolitan Park	35 Miles West of Detroit on I-96 Around Kent Lake (Oakland, Livingston County)	4,300 Acres	Year Around
Stoney Creek Metropolitan Park	North of 26 Mile Road Stoney Creek Lake Macomb, Oakland County	3,500 Acres	Year Around
Marsh Bank Metropolitan Park	6 Miles West of Pontiac, Marsh Lake (Oakland County)	110 Acres	Year Around
Metropolitan Beach	22 Miles from Detroit 4 Miles Southeast of Mt. Clemens, Lake St. Clair (Macomb County)	550 Acres	Year Around
Hudson Mills Metropolitan Park	12 Miles West of Ann Arbor at Cross Roads of North Territorial Road and Huron River (Washtenaw County)	500 Acres	Year Around
Dexter-Huron Metropolitan Park	7-1/2 Miles Northwest of of Ann Arbor at Huron River (Washtenaw County)	Riverside Park	Year Around
Delhi Metropolitan Park	2 Miles East of Dexter Huron Metropolitan Park (Washtenaw County)	Riverside	Year Around
Lower-Huron Metropolitan Park	App. 25 Miles from Detroit on I-94 (Wayne County)	1000 Acres	Year Around

The major parks, Kensington, Metropolitan Beach, Stoney Creek and Lower-Huron cover all recreational activities such as swimming, golfing, fishing, canoeing, camping, picnicking, nature programs and boat rentals to serve a large populace. For example, approximately 4.5 million persons visited Lower Huron Park in 1970. Besides the Huron-Clinton Metropolitan Authoirity there are State, County, Township and City areas set aside for recreation. These areas total 126,612 acres or about 4 percent of the total area for Southeastern Michigan.

The National pattern of locating recreational areas in sparsely populated zones is true for Michigan. Nineteen percent of the total land in Michigan is for recreation; in contrast, four percent of the land area in Southeastern Michigan is for recreation. This relationship becomes more significant when it is noted that Southeastern Michigan incorporates 50% of the population.

Mineral Production

Southeastern Michigan contains various mineral resources. A summary of these materials is shown in Table B-9. Following this table is a brief description of each mineral as it pertains to the region today.

TABLE B-9

Summary of mineral production and value for selected years.

	1968		1965		1960		1955		1950	
Commodity	**Production**	**Value**	**Production**	**Value**	**Production**	**Value**	**Production**	**Value**	**Production**	**Value**
Petroleum (42 Gal. bbls)	625,641	1,846,231	869,387	2,425,584	482,500	1,404,070	120,061	350,578	15,613	42,155
Natural gas (Mcf)	23,520,769	(1/)	21,184,092	(1/)	2,915,112	(1/)	2,234,376	(1/)	3,728,549	(1/)
Salt (tons)	3,367,324	25,349,600	2,889,643	21,989,878	3,102,514	25,150,398	4,066,504	23,673,519	3,693,613	13,559,582
Stone, crushed (tons)	(2/)	(2/)	3,025,313	3,489,107	1,387,830	1,728,491	1,233,238	1,652,253	1,041,793	993,472
Clay (tons)	1,144,639	1,272,077	1,086,480	1,183,840	644,306	707,806	1,001,349	1,041,695	314,197	233,743
Peat (tons)	(2/)	(2/)	101,555	900,535	140,510	2,052,592	29,000	457,500	0	0
Sand and gravel (tons)	23,029,000	24,626,000	22,184,000	21,419,000	14,635,686	14,269,175	16,768,125	15,191,477	9,662,953	7,611,823

1/ Data not available.
2/ Withheld to avoid disclosing individual company confidential data.

Brine Fields

In 1957, a new brine field was developed in St. Clair County using the hydraulic fracturing technique. Two wells were drilled into the saline bearing formations several hundred feet apart and were cased, cemented, and perforated. Brine under high pressure was forced down one well and migrated through the pressure-induced fractures to the second well. Once the connection between wells was established and enlarged, the brine was replaced by fresh water and the wells were placed in production. The hydraulic fracturing technique speeds the process of joint well production by decreasing the time delay for developing interconnecting solution cavities.

The artificial brine removed from the wells is pumped to the surface plants where it is subjected to various treatments depending upon the end use to be made of the brine. Two of the producing fields provide brine for the manufacture of evaporated salt; the remaining two fields yield brine for captive consumption by chemical companies producing chlorine, caustic soda, hydrogen, soda ash, and other related chemicals.

The historic trends, for selected years since 1950, in the quantity and value of salt produced in the study region is presented in Table B-10. These data represent the actual salt produced as well as the salt equivalent of the brine used for chemical manufacturing. See Figure B2 for location.

TABLE B-10

Rock salt and brine production and value for selected years

Year	Quantity (short tons)	Value (dollars)
1950.....	3,693,613	13,559,582
1955.....	4,066,504	23,673,519
1960.....	3,102,514	25,150,398
1965.....	2,889,643	21,989,878
1968.....	3,367,324	25,349,600

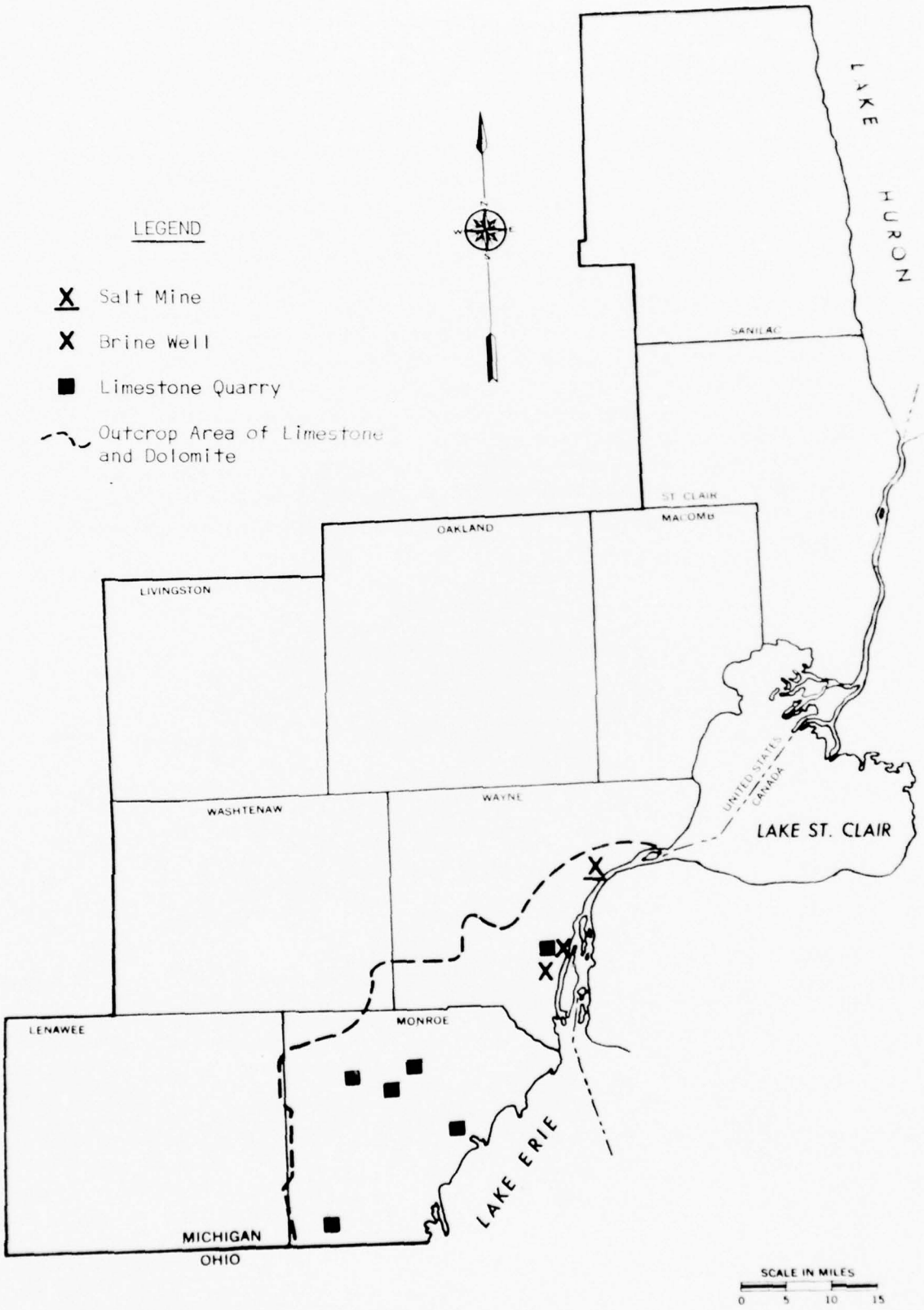

LEGEND
Salt Mine
Brine Well
Limestone Quarry
Outcrop Area of Limestone and Dolomite
LAKE HURON
SANILAC
ST. CLAIR
MACOMB
OAKLAND
LIVINGSTON
WASHTENAW
WAYNE
UNITED STATES
CANADA
LAKE ST. CLAIR
LENAWEE
MONROE
LAKE ERIE
MICHIGAN
OHIO
SCALE IN MILES
0 5 10 15

FIGURE B-3

The number of persons employed in brine production activities is generally limited to one or two maintenance men per field. Those persons employed in the salt or chemical plants are considered to be engaged in manufacturing operations rather than in mineral production. The number of persons employed in the underground mining of rock salt cannot be disclosed without revealing confidential company data.

Water and Land Use in Brine Fields. The production of artificial brines requires inputs of fresh water to the salt bearing formations and the withdrawal of the near saturated brine solutions. The brines are piped to the processing plants where the water is removed and the various salt or chemical products are produced. The water removed from the brines is generally of high purity and is usually discharged at the plant rather than pumped back to the wellhead for recirculation.

The practice of discharge rather than recirculation is expected to continue as long as inexpensive supplies of fresh water are available close to the wellhead. When the fresh water purchase price exceeds the cost of pumping plant water back to the wells, the practice of recirculation will probably be initiated. The consumption of water for brine processing is negligible.

The mining of rock salt requires only negligible quantities of water for surface and underground use. Water seeping into the shaft and mine must be collected and pumped to the surface for disposal. The quantities of water pumped from the mine are negligible since the shaft area is concrete lined and the salt, which flows under pressure, effectively seals many fractures which might allow water to enter the workings.

Very little land surface is involved in the mining of salt or the production of brine.

CRUSHED STONE

TABLE B-11

Crushed stone production and value for selected years

Year	Quantity (short tons)	Value (dollars)
1950	1,041,793	993,472
1955	1,233,238	1,652,253
1960	1,387,830	1,728,491
1965	(1/)	(1/)

1/ Withheld to avoid disclosing individual company data.

Five commercial operations and the Monroe County Highway Department are actively engaged in cruched rock production. In 1967, 72 persons were employed by the crushed stone industry, exclusive of those persons engaged in quarrying rock for the one cement manufacturing operation. Most of the crushed rock producers operate year round with the winter production stockpiled for the annual construction season. The two operations that do not operate on a year round basis produce crushed rock during the construction season which generally runs from April to November.

Water and Land Use in Crushed Stone Operations. Water accumulates in stone quarries as a result of ground water seepage and rain collection. The water is then pumped from the quarry and either discharged to the local drainage system or may furnished to the processing plant. This discharged water is of good quality and does not carry contaminants to the local streams.

Water is used in the processing of crushed stone to remove the small stone particles (fines) that are produced during the crushing operations. Water is also used as the transport medium during the fine grinding of limestone for cement manufacture. Most of the process water is discharged to ponds where the fines are allowed to settle out before the water is diverted to the local drainage system. Recirculation of the wash and grind water is not practiced at the present time because of the relatively small quantities of water involved; however, this practice is expected to be initiated as water use practices become more restrictive in the future. Consumptive losses of water are very minimal in crushed stone operations.

Clay-Shale

The quantity and value of clay produced for selected years since 1950 is presented in Table B-12. The values in this table are for raw clay and do not represent the value of the products manufactured from the clay.

TABLE B-12

Clay and shale production and value for selected years

Year	Quantity (short tons)	Value (dollars)
1950	314,197	233,743
1955	1,001,349	1,041,695
1960	644,306	707,806
1965	1,086,480	1,183,840
1968	1,144,639	1,272,077

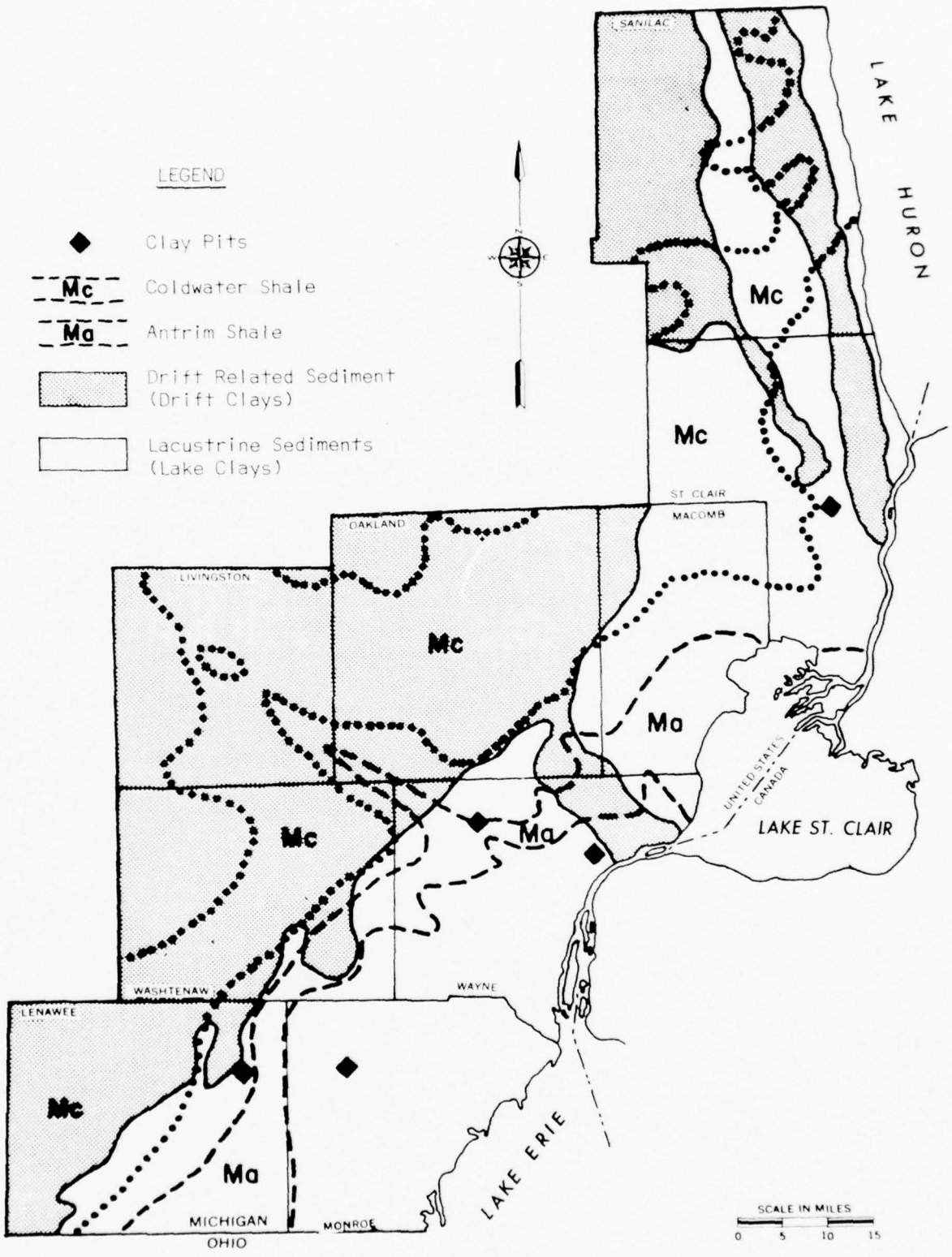

LEGEND
Clay Pits
Mc
Coldwater Shale
Ma
Antrim Shale
Drift Related Sediment
(Drift Clays)
Lacustrine Sediments
(Lake Clays)
SANILAC
LAKE HURON
Mc
Mc
ST. CLAIR
MACOMB
OAKLAND
LIVINGSTON
Mc
Ma
UNITED STATES
CANADA
LAKE ST. CLAIR
Mc
Ma
WASHTENAW
WAYNE
LENAWEE
Mc
Ma
MICHIGAN
OHIO
MONROE
LAKE ERIE
SCALE IN MILES
0 5 10 15

FIGURE B-4

The actual number of persons employed in the mining of clay is not available. Generally, a shovel operator and mechanic are required in the pit with variable numbers of truck drivers depending upon the size of the operation. In some cases, the trucking of clay is contracted to outside firms which compounds the problem of determining the size of the labor force. Based on the data that are available, it is estimated that between 30 and 40 persons are employed in the mining and hauling of clay.

In addition to the surface clay deposits, the study area is underlain, in part, by bedrock formations of shale which may be of value in the manufacture of lightweight aggregates, cement, or other clay products. The Antrim and Coldwater shales of the Mississippian system are of primary importance as clay replacements and underlie that portion of the study region which lacks clay deposits. (See figure B-2). To be of value, these shales must have not only the proper physical characteristics but must also lie close enough to the surface to allow economical extraction by open pit mining methods.

Water and Land Use in Clay-Shale Operations.

The mining of clay does not require any water input nor does it generate any pit water which requires surface disposal. Because clay is nonpermeable material that prevents ground water from entering the pit, the only water accumulation is from atmospheric moisture which is usually insufficient to warrant pumping operations. Although water is used in the manufacture of clay products, this water is not related to raw material production and is, therefore, not included here.

The U.S. Bureau of Mines' strip and surface mine survey shows that through 1964 a total of 155 acres of land had been disturbed by clay mining activity in the region. This toltal includes current production land, abandoned pits, and those reclaimed clay pits known to the surveyors.

Peat Production

Peat production is seasonal with the highest employment recorded during the peak harvest months of April and May and the lowest employment during the winter months. The estimated average number of persons employed in peat production in the area during 1967 is 56.

TABLE B-13

Peat production and value for selected years

Year	Quantity (short tons)	Value (dollars)
1950	0	0
1955	29,000	457,500
1960	140,510	2,052,592
1965	101,555	900,535
1968	(1/)	(1/)

1/ Withheld to avoid disclosing individual company data.

Water is not required in either the mining or the processing of peat. The water that is drained from the bogs is generally diverted to a local water course for discharge. This water is generally of good quality and does not create a disposal problem.

Extensive acreages of land are required for large scale peat mining operations because of the limited harvest per acre per year. The Bureau of Mines' strip and surface mine survey determined that 345 acres of land in the study area had been disturbed by peat mining activities through 1964. Figure B shows the location of the area's peat mines. Since the peat swamps have low topographic relief and are of a boggy nature, there is little competition from agricultural or residential users for this type of land and most of the reserves should be available for the future production of this commodity.

Sand & Gravel

There were 97 producing sand and gravel pits in the study area in 1968. The geographical distribution of most of these pits is presented in figure B-4. Production and dollar value of sand and gravel for selected years is shown in Table B-14

TABLE B-14

Sand and gravel production and value for selected years

Year	*Quantity (short tons)*	Value (dollars)
1950	9,662,958	7,611,823
1955	16,768,125	15,191,477
1960	14,635,686	14,269,175
1965	22,184,000	21,419,000
1968	23,029,000	24,626,000

The U.S. Bureau of Mines' data on employment by sand and gravel producers in 1967 are based on responses from 59 percent of the operators representing 74 percent of the total area production. This data indicates that 712 persons were engaged in production activities with an additional 103 persons in office work. It is therefore estimated that about 1,000 persons are employed annually in sand and gravel production within the study area. Production of sand and gravel is seasonal, generally running from early April to late November with employment reaching its peak during this time. During the winter months only a small staff is employed, chiefly for maintenance and office duties.

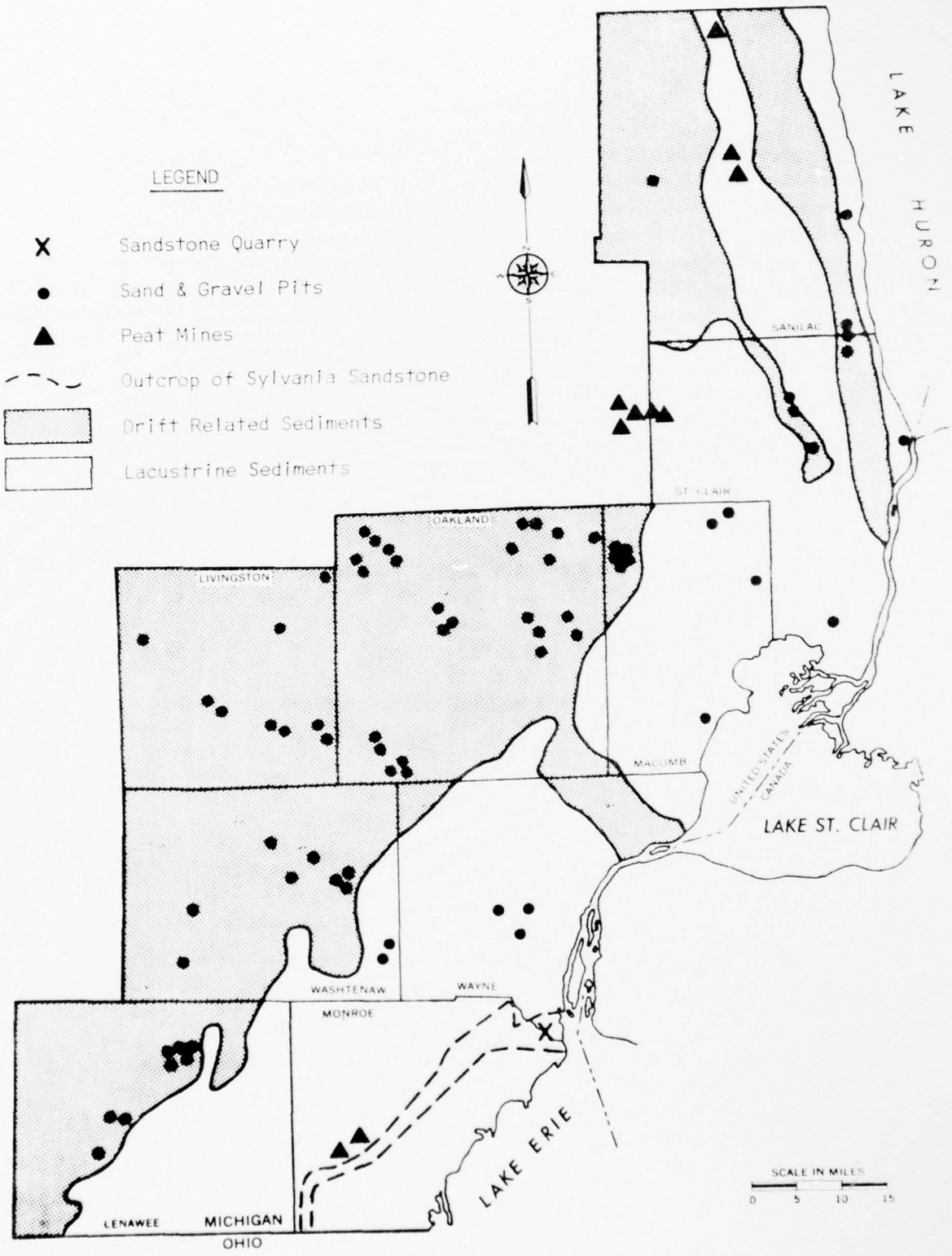

LEGEND
Sandstone Quarry
Sand & Gravel Pits
Peat Mines
Outcrop of Sylvania Sandstone
Drift Related Sediments
Lacustrine Sediments
LAKE HURON
SANILAC
ST. CLAIR
OAKLAND
LIVINGSTON
MACOMB
UNITED STATES
CANADA
LAKE ST. CLAIR
WASHTENAW
WAYNE
MONROE
LAKE ERIE
LENAWEE
MICHIGAN
OHIO
SCALE IN MILES
0 5 10 15

FIGURE B-5

Water and Land Use in Sand and Gravel Operations

Water is used by the sand and gravel industry as a transport medium in dredging operations, as wash water for removing fines, and as a transport medium in heavy media processing plants. The mining of sand and gravel by suction dredge requires large volumes of water. The dredged sand-gravel-water mixture is usually passed through a dewatering plant coupled to the dredge or located adjacent to the pond. The water from this plant is returned to the pond where it is held captive and is recirculated. Because no outlets are provided for the dredge ponds, any fine particles generated during this production operation are retained at the site. These same ponds will often supply water to the processing plants.

The total land disturbed by sand and gravel mining through 1966, as compiled by the U.S. Bureau of Mines, amounts to 5,927 acres. Part of this land is still actively supporting production; part has been reclaimed and put to other uses; and part remains in the unreclaimed state.

PETROLEUM AND NATURAL GAS.

TABLE B-15

CUMULATIVE AND 1968 PETROLEUM AND NATURAL GAS PRODUCTION BY COUNTRY

	Cumulative production		1968 production	
County	**Oil (bbls)**	**Gas (Mcf)**	**Oil (bbls)**	**Gas (Mcf)**
Lenawee	12,196	132,291	298	69,265
Livingston	1,676	23,741,734	868	8,703
Macomb	33,772	31,938,054	10,479	4,163,186
Monroe	708,121	0	3,701	0
Oakland	30,983	13,737	979	0
Sanilac	0	0	0	0
St. Clair	7,263,031	97,302,820	581,450	19,143,167
Washtenaw	760,090	7,518,343	17,224	93,001
Wayne	205,241	10,948,906	10,642	43,447
Total	9,015,110	171,595,885	625,641	23,520,769

The historical trend of petroleum and natural gas production and value for selected years since 1950 is shown in table B-16. See Figure B-5 for location.

TABLE B-16

PETROLEUM AND NATURAL GAS PRODUCTION AND VALUE FOR SELECTED YEARS

	Petroleum		Natural gas	
Year	Production (bbls)	Value (dollars)	Production (Mcf)	Value (dollars)
1950	15,613	42,155	3,728,549	(1)
1955	120,061	350,578	2,234,376	(1)
1960	482,500	1,404,070	2,915,112	(1)
1965	869,387	2,425,584	21,184,092	(1)
1968	625,641	1,846,231	23,520,769	(1)

1 Information not available.

Data on the number of field personnel and drill crews employed by the petroleum and natural gas producers is not available. Those persons engaged in the refining of petroleum are considered to be manufacturing personnel rather than mineral production employees.

The oil and gas formations are in the Silurian and Ordovician systems which are from 100 to 3,000 feet deep. The proven reserves are sufficient for four or five years at current use. But the uncertainity of finding new fields makes projection of these mineral resources impossible.

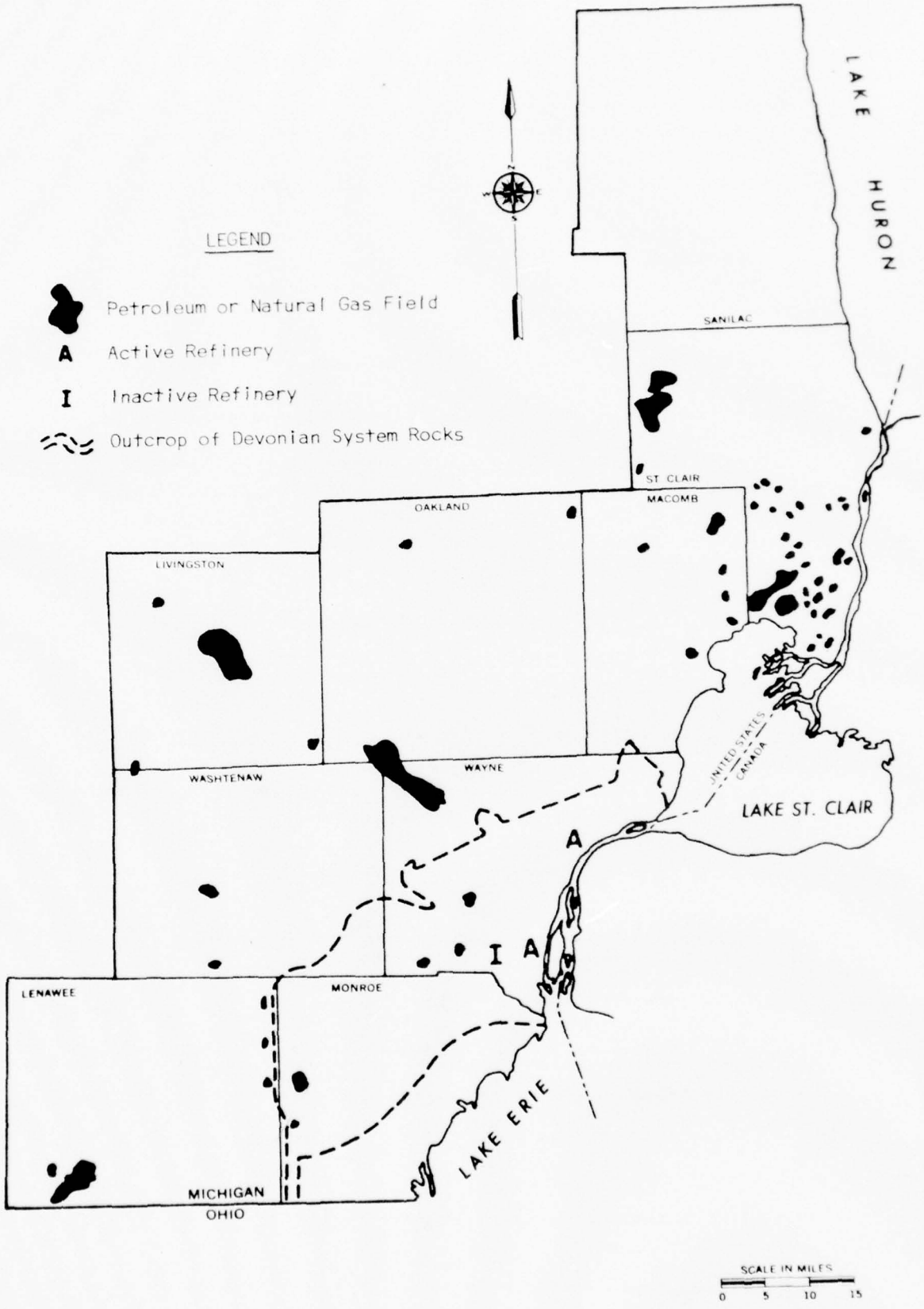

LEGEND
Petroleum or Natural Gas Field
A Active Refinery
I Inactive Refinery
Outcrop of Devonian System Rocks
LAKE HURON
SANILAC
ST. CLAIR
MACOMB
OAKLAND
LIVINGSTON
WASHTENAW
WAYNE
UNITED STATES
CANADA
LAKE ST. CLAIR
A
I A
LENAWEE
MONROE
LAKE ERIE
MICHIGAN
OHIO
SCALE IN MILES
0 5 10 15

FIGURE B-6

Source of Pollution

The sources of pollution from the urbanized areas of the region are essentially of three types. (1) stormwater outlets, (2) industrial outfalls, and (3) sewage plant outfalls. These sources have been inventoried by type, receiving waters, treatment provided, effluent characteristics, and status regarding current abatement action, and are listed in Inclosure 1 to Background Appendix. The degree and significance of pollution from agricultural and vacant land by means of runoff into streams has not been estimated to date. Such pollution, however, demands consideration in the formulation of alternative wastewater treatment systems.

Stormwater Runoff

The City of Detroit has a combined sewer system which dominates the region's urbanized area. Some of the older nearby communities also depend on combined systems. As new communities have developed, separate storm and sanitary sewers have been installed. The Detroit Metropolitan Water Department, which serves a number of surburban communities with sewer service, has developed and installed a sewer monitoring system. The "Lake Erie Report" of 1968 concluded that 10 billion gallons of municipal pollution, along with industrial waste water, has accelerated the natural aging process of Lake Erie at a dramatic rate.

Appendix , Ecological Assessments for Wastewater Management in Southeastern Michigan gives additional information concerning the form of this pollution.

THE STUDY AREA IN THE FUTURE

DEMOGRAPHIC PROJECTIONS

These population projections were developed out of activities of the Southeastern Michigan Water Resources Study - Economic Workshop subcommittee and 1970 census figures Department of Comm. Basic data were supplied by SEMCOG with projection methods and results developed by the U.S. Army Engineer District, Detroit.

The population projections for the area are shown in Table B-17.

TABLE B-17

POPULATION PROJECTION BY SUBAREA, FOR SOUTHEASTERN MICHIGAN

Sub Area	1970	1980	1990	2000	2010	2020
1	111,989	128,477	148,023	168,254	191,759	218,603
2	3,049,088	3,387,798	3,783,247	4,181,164	4,643,102	5,163,530
3	1,097,077	1,303,178	1,556,057	1,818,668	2,130,262	2,409,586
4	265,468	362,183	444,154	538,946	644,992	758,118
5	163,627	181,169	198,878	226,171	253,288	280,969
Total	4,687,249	5,362,805	6,130,269	6,933,203	7,863,400	8,830,806

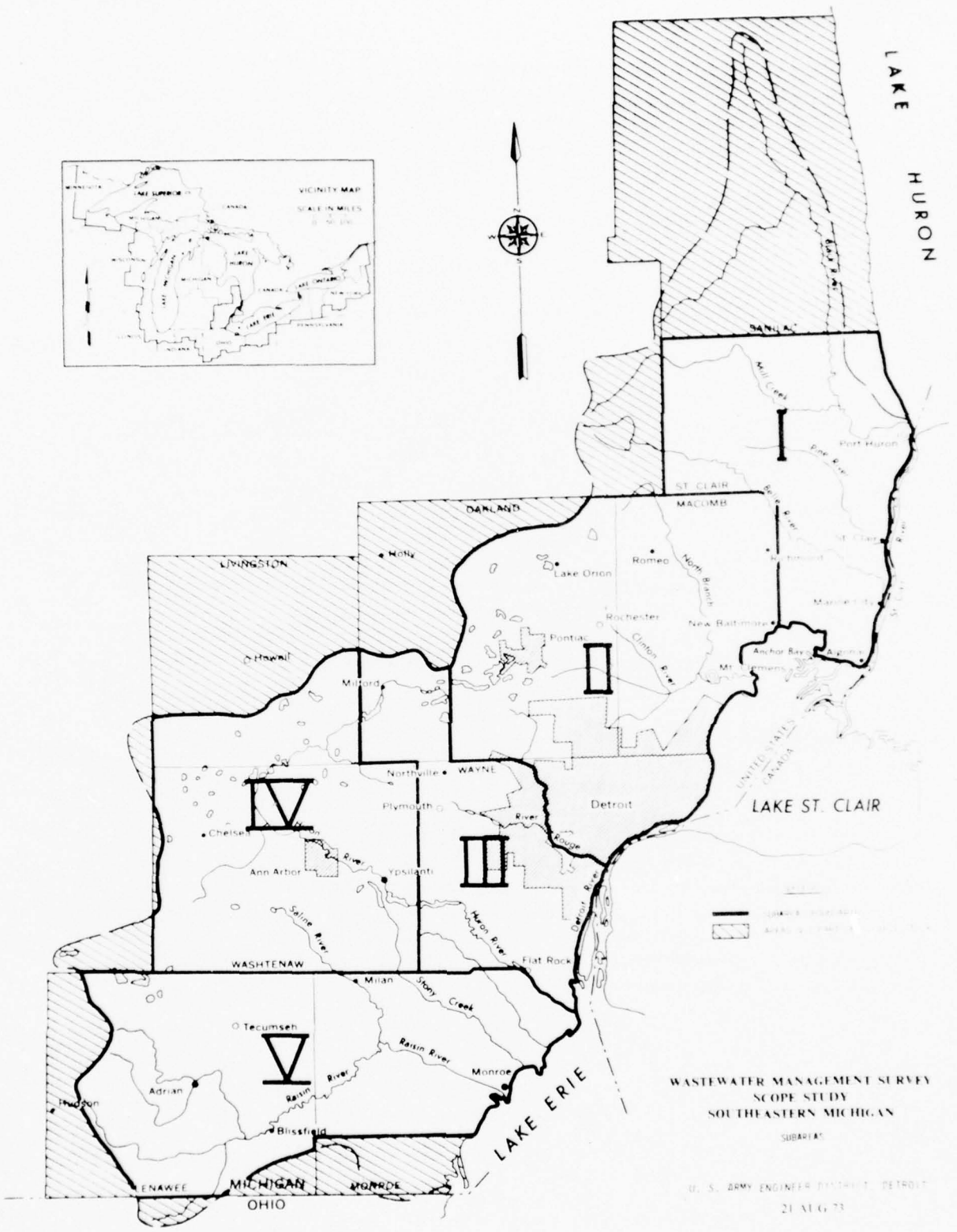

VICINITY MAP
SCALE IN MILES
LAKE HURON
SANILAC
ST. CLAIR
MACOMB
OAKLAND
LIVINGSTON
HONE
Lake Orion
Romeo
North Branch
Rochester
Pontiac
New Baltimore
Clinton River
Anchor Bay
Hawaii
Milford
Northville
WAYNE
Detroit
LAKE ST. CLAIR
Plymouth
Chelsea
Ann Arbor
Ypsilanti
Saline River
Huron River
Rouge River
Detroit River
Flat Rock
WASHTENAW
Milan
Stony Creek
Tecumseh
Raisin River
Monroe
Adrian
Raisin River
Hudson
Blissfield
LAKE ERIE
LENAWEE
MICHIGAN
OHIO
MONROE
WASTEWATER MANAGEMENT SURVEY
SCOPE STUDY
SOUTHEASTERN MICHIGAN
SUBAREAS
U. S. ARMY ENGINEER DISTRICT, DETROIT
21 AUG 73
SCALE IN MILES
0 5 10 15

FIGURE B-7

SEMCOG employed the Battelle Institute to develop revised population projections for its seven county southeastern Michigan region on the basis of the returns from the 1970 Census and the indicated lower birthrate. The firm had developed a previous set of projections, both economic and population, in 1967 for the special TALUS project. The new population projections for 1990 were about 800,000 lower than the previous ones in 1967.

With this important revision in mind, the following projections have been developed for the full nine-county southeastern Michigan region.

TABLE B-18

1990 POPULATION PROJECTION FOR NINE COUNTY AREA

Nine-County Region	1950	1960	1970	1990
Totals	3,440,259	4,291,457	4,851,346	6,291,300
20-year gains, numbers			1,411,089	1,439,952
20-year gains, percent			41.0	29.6

The population of the region is projected to continue to grow, but at a slower rate than for the previous 20 year period. The basis of the growth will be primarily through natural increase, with only a small portion developing from in-migration. The economy is anticipated to continue active, but not as expansive as in the previous two decades. With a larger population base, the demands for both goods and services will undoubtedly increase, thus spurring further economic activities.

ECONOMIC PROJECTIONS

Total employment for the Southeastern Michigan region is projected to rise to 1,815,105 in 1990, representing a gain of 622,795 or 25.5% over 1970. There was a 34.4% gain in the previous 20-year period from 1950 to 1970. Though manufacturing employment is expected to rise by approximately 35,000 by 1990, its share of total employment will decline from 36.8% to 28.8%. The largest gains are projected in service and professional employment where an increase of over 305,000 is expected. Retail trade employment is scheduled to increase 71,000 and wholesale trades over 16,000. Public administration employment is projected to rise some 65,700. Agriculture, forestry and fishing are expected to continue to decline in employment. Table B-19 provides more details.

Land Use Patterns for St. Clair, Macomb, Oakland, Wayne, Washtenaw and Monroe Counties adapted from 8 August 1969 Comprehensive 1990 Plan Map from The Detroit Regional Transportation and Land Use Study — courtesy of Southeast Michigan Council of Governments.

Base map from Great Lakes Basin Framework Study.

Wastewater Management Feasibility Study
Southeast Michigan — Lake Erie
GENERALIZED LAND USE PATTERN —
PROJECTED, 1990

U.S. Army Corps of Engineers, Detroit District.

TABLE B-19

PROJECTED EMPLOYMENT

SOUTHEASTERN MICHIGAN REGION

1970 - 1990

INDUSTRY GROUP	1950	1970	Change
Agriculture, Forestry and Fishing	15,265	11,900	- 3,365
Mining	2,130	2,600	470
Construction	81,074	94,500	13,426
Manufacturing	667,222	702,300	35,078
Food	16,804	14,200	- 2,604
Textiles	7,257	12,000	4,743
Chemicals	19,464	25,300	5,836
Metals	91,855	110,200	18,345
Transp. Equipment	299,455	296,800	- 2,655
Other Mfg.	232,387	244,000	11,613
Wholesale	70,492	86,700	16,208
Retail	281,524	352,600	71,076
Services	475,257	827,200	305,251
Professional, etc.	46,692		
Public Administration	70,822	136,500	65,678
Other	104,627	223,600	118,973
TOTALS	1,815,105	2,437,300	622,795

NATURAL RESOURCES

Future Land Use

The 1990 land use development pattern, provided by SEMCOG's special project TALUS in 1968 was approved in August, 1968. Since that date, progressive refinements in terms of functional plans for the Southeastern Michigan region have been developed and adopted by SEMCOG. Each of these has had an impact on the general projected land use pattern. More specifically, SEMCOG is presently engaged in reducing the original 1990 land use allocations in order to conform with the lower 1990 population projections for the region.

In 1971, SEMCOG adopted a Southeast Michigan Regional Water, Sewerage and Storm Drainage Plan for its 7-county area (Lewanee County not included). This plan was designed to accommodate a population of 6.9 million in 1990. In 1972 SEMCOG adopted a Regional Recreational and Open Space Lands Plan, greatly modifying a similar plan developed in 1968 by TALUS. This new plan was designed to meet the lesser land demands of the 6.1 million population more recently projected for 1990. SEMCOG is now in the process of adopting a Solid Waste Disposal Plan for its territory, based on the lower population projection.

For these reasons, the Generalized Land Use Pattern - Projected, 1990 (TALUS) no longer conforms to the more restricted 1990 population needs. (Figure B-7) The plan is useful if regarded as a post-1990 land use plan, perhaps for the year 2000.

This plan projects a continuation and "beefing up" of the industrial corridors of the region, an increase in the encircling outspread of residential development, and larger regional recreation areas. Agricultural and vacant land is decreased significantly.

It is expected that Detroit will remain the major population and economic center of the region. Beyond this city's borders considerable population and economic growth are expected in such cities as Warren and Sterling Heights in Macomb County; Southfield and Troy in Oakland County; Dearborn, Livonia and Westland in Wayne County, and the Ann Arbor-Ypsilanti complex in Washtenaw County, as well as the Monroe City and Porton Huron City complexes in Monroe and St. Clair Counties, respectively.

Regional recreational and open space developments are planned for 1990 in connection with the major waterways and bodies of water within the region. At a more refined scale, county and municipal development of recreation resources by utilization of the flood plains of the Black, Huron, Clinton, Raisin, and Rouge Rivers is expected. Use is expected to be made of the open space and recreational potentials in the morainal areas of the western portions of Oakland and Washtenaw Counties. The shore lines of the St. Clair River, the Detroit River and Lake Erie offer further potentials for recreational facilities at local, county, regional and state levels.

FUTURE MINERAL PRODUCTION

A summary of projected mineral production for the future is shown in Table B-20. A summary of water use is shown in Table B-21.

TABLE B-20

SUMMARY OF PROJECTED MINERAL PRODUCTION

(Thousands of short tons)

Commodity	1980	2000	2020	1968 to 2020 Cumulative production
Salt	4,800	10,200	21,600	515,400
Crushed stone	4,250	6,840	10,980	333,800
Clay	1,330	2,140	3,430	104,380
Peat	130	170	210	8,240
Sand and Gravel	28,580	47,750	79,780	2,336,080

TABLE B-21

SUMMARY OF PRINCIPAL MINERAL INDUSTRY WATER USE REQUIREMENTS IN 1968 AND THE PROJECTION YEARS 1980, 2000 and 2020

Millions of Gallons Per Day

Year	Commodity	Intake	Discharge	Recirculated	Consumed	Total
	Salt	3.9	3.9	-0-	-0-	3.9
1968	Stone, crushed	1.0	1.0	-0-	-0-	1.0
	Sand and Gravel					
	(annual)	36.6	35.6	29.8	1.0	66.4
	(seasonal)	54.7	53.2	44.5	1.5	99.2
	Total Annual	41.5	40.5	29.8	1.0	71.3
	Salt	5.8	5.8	-0-	-0-	5.8
1980	Stone Crushed	1.2	1.2	-0-	-0-	1.2
	Sand and Gravel					
	(annual)	49.6	48.2	43.0	1.4	92.6
	(seasonal)	74.2	72.1	64.3	2.1	138.5
	Total Annual	56.6	55.2	43.0	1.4	99.6
	Salt	14.1	14.1	-0-	-0-	14.1
2000	Stone, crushed	1.5	1.5	0.5	-0-	2.0
	Sand and Gravel					
	(annual)	85.2	92.7	78.2	2.5	163.4
	(seasonal)	127.4	123.7	117.0	3.7	244.4
	Total Annual	100.8	98.3	78.7	2.5	179.5
	Salt	31.6	31.6	-0-	-0-	31.6
2020	Stone, crushed	1.5	1.5	1.7	-0-	3.2
	Sand and Gravel					
	(annual)	138.1	134.0	135.1	4.1	273.2
	(seasonal)	206.6	200.4	202.1	6.2	408.7
	Total Annual	171.2	167.1	136.8	4.1	308.0

Brine Fields - Reserves and Projected Production.

The salt reserves underlying the study region are almost beyond calculation. The 550 feet of salt within the Salina group beneath Wayne County alone is sufficient to support the current production rate for the next 200,000 years.

The projected salt production for the next 50 years from the area is based on the projected national growth rate for this commodity (Table B-22). Sufficient reserves of salt exist to support this production projection.

TABLE B-22

PROJECTED SALT PRODUCTION

Year	Thousand short tons
1968 (actual)	3,367
1989	4,800
2000	10,200
2020	21,600
1968-2020 (cumulative	515,400

Water use projections for future brine production are presented in Table B-23.

TABLE B-23

PROJECTED WATER USE REQUIREMENT FOR ARTIFICIAL BRINE PRODUCTION

	Million of gallons per day				
Year	Intake	Discharge	Recirculated	Consumed	Total
1968	3.9	3.9	-0-	-0-	3.9
1980	5.8	5.8	-0-	-0-	5.8
2000	14.1	14.1	-0-	-0-	14.1
2020	31.6	31.6	-0-	-0-	31.6

Crushed Stone

The projected crushed stone production is shown in Table B-24.

TABLE B-24

PROJECTED CRUSHED STONE PRODUCTION

Year	Thousand short tons
1968 (actual	(1/)
1980	4,250
2000	6,840
2020	10,980
1968-2020 (cumulative)	333,800

1/ Withheld to avoid disclosing individual company confidential data.

Table B-25 shows the projected water use and land requirements.

TABLE B-25

PROJECTED WATER USE REQUIREMENTS FOR CRUSHED STONE PRODUCTION

Year	Millions of gallons per day				
	Intake	Discharge	Recirculated	Consumed	Total
1968	1.0	1.0	-0-	-0-	1.0
1980	1.2	1.2	-0-	-0-	1.2
2000	1.5	1.5	0.5	-0-	2.0
2020	1.5	1.5	1.7	-0-	3.2

The total land area disturbed by stone quarrying operations through 1966 is 575 acres. New land necessary to support the projected production of stone in the three projection years is presented in Table B-26

TABLE B-26

LAND REQUIRED FOR CRUSHED STONE MINING

Year	Acreage
1968	20
1980	25
2000	41
2020	66
1968-2020 (cumulative)	2,000

The cumulative new land required to maintain the projected production through the ye 2020 is 2,000 acres.

Clay-Shale

The projected clay production in the area for the years 1980, 2000 and 2020 is presented in Table B27. These projections are based, in part, on the national growth rate for clay and cement production as well as the historic growth trend for clay production in the region. Although no specific determination of the reserves of clay or shale is available, it appears that more than ample reserves exist to fulfill these future production estimates.

TABLE B-27

PROJECTED CLAY PRODUCTION

Year	Thousand Short tons
1968 (actual	1,144
1980	1,330
2000	2,140
2020	3,430
1968-2020 (cumulative	104,380

New land that must be disturbed by clay mining each year in order to meet the projected production requirements is shown in Table B28 for 1968 and the projection years. Once the clay is removed from a parcel of land, reclamation and sequential use follow and new clay bearing land must be found to replace the depleted deposits.

TABLE B-28

LAND REQUIRED FOR CLAY MINING

Year	Acreage
1968	16
1980	19
2000	31
2020	49
1968-2020 (cumulative)	1,510

Peat Production

The projected peat production for 1980, 2000 and 2020 is presented in Table B29. The large peat deposits in Sanilac County and the remaining reserves in St. Clair County are ample enough to meet this projected peat production.

TABLE B-29

PROJECTED PEAT PRODUCTION
(Thousands of short tons)

Year	Peat Production
1968 (actual)	(1/)
1980	130
2000	170
2020	210
1968-2020 (cumulative)	8,240

1/ Withheld to avoid disclosing individual company confidential data.

Land required for peat production is shown in Table B30

TABLE B-30

LAND REQUIRED FOR PEAT MINING

Year	Acreage
1968	700
1980	950
2000	1,200
2020	1,600
1968-2020 (cumulative)	2,600

The location of adequate reserves of peat close to the prime market areas is a continual problem for the area producers. Peat is a high bulk commodity and transportation costs can mount rapidly if long haul distances are required to bring the product to market.

A serious environmental problem exists in the reclamation of mined out bogs. The swampy character of this land often hampers the potential development of sequential land use. Lakes have been created on some of this land by excavating the underlying clay and using the excavated material to increase the surrounding land elevation. In most cases the cost of hauling fill material into the area is prohibitive and precludes this means of increasing the land level. Some bogs in which the peat has not been completely mined out are used for cultivation of specialized agricultural crops such as blueberries and sod. Other feasible uses of mined peat land include wildlife refuges, parks, public hunting grounds and fish hatcheries. Advanced land use planning is necessary to reduce the cost and expedite the development of these reclaimed lands.

Sand and Gravel

Table B-31 shows projected sand and gravel production.

TABLE B-31

PROJECTED SAND AND GRAVEL PRODUCTION

Year	Thousand short tons
1968 (actual)	23,029
1980	28,580
2000	47,750
2020	79,780
1968-2020 (cumulative)	2,336,080

Water Use For Sand and Gravel Production is shown in Table B-32

TABLE B-32

PROJECTED ANNUAL AND SEASONAL WATER USE REQUIREMENTS FOR SAND AND GRAVEL PRODUCTION

Millions of gallons per day

Year		Intake	Discharge	Recirculated	Consumed	Total
1968	*(Annual)*	36.6	35.6	29.8	1.0	66.4
	(Seasonal)	54.7	53.2	44.5	1.5	99.2
1980	*(Annual)*	49.6	48.2	43.0	1.4	92.6
	(Seasonal)	74.2	72.1	64.3	2.1	138.5
2000	*(Annual)*	85.2	82.7	78.2	2.5	163.4
	(Seasonal)	127.4	123.7	117.0	3.7	244.4
2020	*(Annual)*	138.1	134.0	135.1	4.1	273.2
	(Seasonal)	206.6	200.4	202.0	6.2	408.7

Land requirements for 1968 and the three projection years are presented in Table B33. Between 1968 and 2020 a total of 21,538 acres of sand and gravel bearing land must be made available to the industry if the projected production is to be achieved.

TABLE B-33

LAND REQUIRED FOR SAND AND GRAVEL MINING

Year	Acreage
1968	211
1980	262
2000	438
2020	732
1968-2020 (cumulative)	21,538

Beneficiation of low quality deposits is possible, but at a higher production cost and subsequent higher selling price. Immediate action must be taken to preserve the sand and gravel deposits if the price of this construction material is to be kept at its current level of about one dollar per ton.

WASTEWATER FLOW PROJECTION

Industrial

These projections are based on five primary Standard Industrial Codes (SIC): Food and kindred products (20); paper and allied products (26); chemical and allied products (28); petroleum and coal products (29); primary metal industry (33); and other industries.

Data was obtained pertaining to these SIC codes for Southeastern Michigan from which a distribution factor was established for each SIC code per subarea. The resulting projected industrial flows are shown in Table B34.

TABLE B-34

PROJECTED INDUSTRIAL WASTEWATER FLOWS (MGD)

Subarea	1970 (MGD)	1980 (MGD)	1990 (MGD)	2000 (MGD)	2010 (MGD)	2020 (MGD)
I	43.5	35.6	21.2	23.0	26.6	34.3
II	437.6	358.6	309.3	255.0	384.8	348.3
III	484.5	317.0	272.8	218.2	256.0	314.8
IV	207.1	200.0	189.0	170.8	188.0	248.2
V	44.0	40.1	36.0	38.0	45.3	51.4
TOTALS	1216.7	951.3	828.3	705.0	800.7	997.0

These projections were coordinated with the Michigan Water Resources Commission. The basic data for industrial flows were based on projections by Water Supply Work Group, Great Lakes Basin Framework Study, and Permit Section, Corps of Engineers, Detroit District.

Municipal

Based upon the assumption that municipal wastewater is proportional to population density, the following projections (Table B35) were obtained using base data from Southeastern Michigan Water Resources Study of Municipal Water Supply.

TABLE B-35

PROJECTED MUNICIPAL WASTEWATER FLOWS (MGD)

Subarea	1970	1980	1990	2000	2010	2020
I	10.2	12.3	14.8	17.4	20.8	24.5
II	277.7	325.5	379.4	430.9	502.7	577.8
III	99.9	125.2	156.1	187.4	230.6	269.6
IV	24.2	34.8	44.5	55.5	69.8	84.8
V	14.9	17.4	19.9	23.3	27.4	31.4
TOTALS	426.9	515.2	614.7	714.5	851.3	988.1

The five basic subareas were analyzed and design criteria was established for various wastewater alternative systems which resulted in the selection of seven sites for wastewater treatment in the year 1990 (see Table B-36).

TABLE B-36

POTENTIAL WASTEWATER TREATMENT SITES, 1990

Subarea		
I	Port Huron	24 MGD
I	East China	8 MGD
I	Algonac	4 MGD
II, III	Detroit	806 MGD
III	Wyandotte	125 MGD
II, III, IV	Mouth of Huron	400 MGD
V	Monroe	40 MGD
V	Adrian-Tecumseh	12 MGD
	Outside Area	24 MGD
	TOTAL	1,443 MGD

Stormwater

Stormwater is addressed in the Design Cost Appendix in the Stormwater Control Design Criteria Section.

PLANNING OBJECTIVES OF SOUTHEASTERN MICHIGAN

INTRODUCTION

In this section, an effort is made to define regional goals in regard to wastewater management as aims, aspirations, purposes and ends, in relation to the social, economic and environmental well-being of the people of southeastern Michigan.

Objectives are viewed as identifiable and measurable steps toward the attainment of goals. They represent work points along a path reaching to the goal, and hence are performance measures. Objectives may and should be characterized by time of accomplishment in relation to progress toward goals.

People, individually and collectively, are the primary concern of both goals and objectives. Their immediate and future conditions and needs are tied intimately to the uses and abuses of water and to the land uses related to this natural element. The people's well-being, in the present and in the long run, is the basic yardstick for the use, quality, preservation and enchancement of both water and land.

NATIONAL PERSPECTIVE

"Well-being of all the people shall be the overriding determinant (our emphasis) in considering the best use of water and related land resources. Hardship and basic needs of particular groups within the general public shall be of concern, but care shall be taken to avoid resource use and development for the benefit of a few or the disadvantage of many. In particular, policy requirements and guides established by the Congress and aimed at assuring that the use of natural resources, including water resources, safeguard the interests of all our people, shall be observed."

(Water Resources Council statement, issued May 29, 1962, Document No. 97, 87th Congress, 2nd Session, p.2)

Four objectives were recommended in 1969 by the Special Task Force on Procedures for Evaluation of Water and Related Land Resource Projects in its report to the Water Resources Council. These objectives were as follows:

A. National Income
B. Regional Development
C. Enironment
D. Well-Being

The Great Lakes Basin Commission has re-arranged and expanded upon these four objectives, relating them to the people of the Great Lakes Region:

1. Social Well-Being.
2. National Economic Development.
3. Quality of the Environment.
4. Regional Development

It is within the framework of the statements developed by the above agencies that the Southeastern Michigan Wastewater Management Study has the responsibility for relating these goals and objectives to the people and to the wastewater management situation in the region.

Background of Goals Formulation Efforts in the Southeastern Michigan Area

Much effort was expended by agencies and organizations in the Southeastern Michigan area to formulate metropolitan or "regional" goals. As early as 1947, the former Detroit Metropolitan Area Regional Planning Commission enunciated a set of four purposes which had the effect of "regional goals". These were as follows:

"A. To guide the physical development of the metropolitan area toward a more orderly, convenient and attractive region in which to live and work.

"B. To effect economies in the region through the recommendation of sound development.

"C. To further cooperation between governmental and private agencies toward these ends.

"D. To make available to public and private agencies, and to the citizens of the region, knowledge on economic social and physical aspects of the region".
aspects of the region".

The Forum for Detroit Area Metropolitan Goals in the early 1960's carried on some intensive work in goals formulation. The organization sought to refine four types of metropolitans goals: Physical; Economic; Social/Cultural; and Governmental. Through annual conferences and working seminars, the Forum made a significant effort to involve citizens of the area in the goals formulation process. Unfortunately, its work ceased in the mid 1960's.

The Talus project of the Southeast Michigan Council of Governments enuniciated metropolitan regional goals in the course of its study. These goals were published in August, 1969. This regional transportation and land use study began as a special project of the Detroit Metropolitan Area Regional Planning Commission and later was taken over and concluded by the Commission's successor, the Southeast Michigan Council of Governments.

The Metropolitan Fund, Incorporated, in 1970 proposed a set of 5 possible goals: (1) Economic goals; (2) Cultural goals; (3) Housing goals; (4) Transportation goals; and (5) Communication goals. These goals, however, were not expanded into specifics.

SEMCOG GOALS.[1]

Most recently, the Southeast Michigan Council of Governments has formulated and adopted a statement on "Goals for the 1990 Regional Development Plan". This document spells out the goals and objectives toward which SEMCOG's plans have been and are being developed. It must be noted that SEMCOG is the official planning agency for seven counties and that it was established under Enabung State legislation (Act 281 of 1945, as amended). It is so recognized by the Federal government (Office of Management and the Budget, and various departments) and has been assigned the A-95 review responsibilities for grant-in-aid programs.

The Preamble to the SEMCOG goals document states:

"The purpose and strategy of the 1990 Regional Development Plan is to provide a large-scale framework to guide the growth and development of the Region for the benefit of the people who live here now and for those who will be coming into the area over the next several decades...Plans for new settlement and population growth need to include the required complements of public facilities and amenities."

The SEMCOG General Overall Goal is formulated as follows:

"To improve the physical and social environment of the southeastern Michigan region, in quality and structure, so as to enable the people of the region, as individuals and as groups, to live, work, and enjoy life better, with opportunity for choice of employment, economic enterprise, housing neighborhoods and communities, educational, recreational and cultural advance. The economic welfare of the people, as families, as communities and as a metropolitan region, is basic to this overall goal. Hence an active, expanding *and diversifying economy is of* over-riding importance."

The rest of the document deals with six specific or functional goals, including land use, transportation, public facilities, open space and recreational lands, housing and fiscal matters. Several of these more detailed goals relate intimately with the objectives of this study: In regard to Land Use, the SEMCOG goal is:

"To formulate and maintain a land use development pattern that will provide the people of the region with convenient, congenial and economically related residential, commercial, manufacturing, recreational and other public areas that can be readily served by networks of the necessary public facilities, such as, water supply, sanitary sewers and treatment plants, transportation, solid waste disposal, and storm drainage. (Underlining added.) Such a land development pattern must give careful consideration to natural resources and other environmental factors related to the well-being of the people..."

The SEMCOG goal on Public Facilities is stated as follows:

"To improve and protect the environmental health of the people of the region and to organize and maintain regional systems of water supply, sanitary sewers and treatment plants, storm drainage and solid waste disposal facilities that will at least equal the environmental standards set by the State and Nation, and will most economically serve the households and economic enterprises of the region."

The SEMCOG Goal is deeply concerned with the financing of public facilities, and is stated:

"To assure efficient utilization of local, state and national funds and an appropriate share of private capital for the accomplishment and general support of the general regional development plan of public facilities, such as, transportation, water mains, sanitary sewer interceptors, sewage treatment plans, storm drainage facilities, solid waste disposal, and land for parks and open space." Underlining added.

SEMCOG and its predecessors have been engaged in the formulation and adoption of various functional plans for the seven-county region. These will be considered in the following sections of the Appendix.

It should be noted that long before the initiation of the Southeastern Michigan Water Resources Study, the Corps of Engineers and SEMCOG had been working together with a common interest in a number of problems and studies. These included flood plain information and control, rain and stream gage networks, and the like. Staff members of both agencies today continue to serve on councils and committees of the other agency, with significant assistance to each agency's programs through these liaison relationships.

The primary goal of the wastewater management study may be stated simply as the elimination of critical pollutants in southeastern Michigan. To this end, the study has sought to develop alternative wastewater treatment systems that would achieve this goal. Each of the systems involves the utilization of various types of wastewater treatment and the use of specific facilities.

The goal of "zero discharge of critical pollutants" is consistent with and supportive of SEMCOG goals in regard to the protection and improvement of environmental health of the people of the region, the establishment of public facilities for wastewater treatment, and the improvement of the physical environment.

WATER MANAGEMENT NEEDS AND PROBLEMS

WATER SUPPLY

The estimated ground yield from 70 percent flow duration for Southeastern Michigan is as follows:

TABLE B-37

Estimated Ground Yield

Subbasin	Runoff 70% (cfsm)	Yield (MGD)
Black River	0.05	20
St. Clair Complex	.10	40
Clinton River	.25	125
Rouge Complex	.15	70
Huron River	.30	165
Swan Creek Complex	.10	20
Raisin River	.20	160
TOTAL		600 (MGD)

Water Withdrawal Requirements-Present and Projected[14]

Municipal Water Use

The major regional water supplier is the city of Detroit, which currently draws its water from the Detroit River. In 1966 the Detroit Department of Water Supply pumped 207 billion gallons for an estimated 3.47 million persons. As the regional system continues to grow, the service is anticipated to extend to many points throughout the study area. Of the 240 central water systems operating in the GLBC planning subarea 4.1 in 1965, 93 systems obtained water from Lake Huron, St. Clair River, Lake St. Clair, Detroit River and Lake Erie, 7 drew water from inland surface waters, and 138 relied upon ground water; two systems tapped both inland surface and ground water sources. In the mid-1960's municipal water use exceeded 650 mgd. Over 50 percent of the total went to users located in minor basins draining directly into the Great Lakes and their connecting channels. Over 90 percent of the water used by municipalities is from the Great Lakes and connecting channels.

As shown in Table B-39, the 1970 average daily municipal withdrawal in Planning Subarea 4.1 from the Great Lakes and connecting channels was estimated to be about 675 mgd. The projected figure for 2020 is 1666 mgd, a total increase of almost one billion gallons daily.

Depletion ("consumption") of water in domestic and commercial use is considered to continue to be about 10 percent of withdrawals. Consumption of water supplied by municipalities to industry is assumed to take place at the rates calculated by the U.S. Bureau of Domestic Commerce for "other manufacturing" for a given year. In this area, this rate rises from 5 percent in 1970 to 16 percent in 2020.

The use of inland lakes and streams and ground water in southeastern Michigan for municipal water supply is expected to decrease as more and more cities switch sources in favor of Great Lakes water. Total withdrawal requirements from these sources of supply are expected to decrease from 63.5 mgd in 1970 to 44.4 mgd in 2020. The Detroit Department of Water Supply is currently constructing an intake in Lake Huron to supply water to many southeastern Michigan communities.

TABLE B-38

SUMMARY OF MUNICIPAL, INDUSTRIAL,

AND RURAL WATER USE

PLANNING SUBAREA 4.1

(MGD)

YEAR	1970				1980				2000				2020			
USE	mun.	ind.	rural	total	mun.	ind.	rural	total	mun.	ind.	rural	total	mun.	ind.	rural	total
Michigan	738.9	1297	49.4	2085	891.7	900	54.2	1846	1236	589	63.3	1889	1710	1092	67.7	2870
Total	738.9	1297	49.4	2085	891.7	900	54.2	1846	1236	589	63.3	1889	1710	1092	67.7	2870
Michigan	60.8	135	11.9	208	79.6	173.7	13.5	266.8	136.6	372.7	15.6	525	207.8	896	17.3	1121
Total	60.8	135	11.9	208	79.6	1737	13.5	266.8	136.6	372.7	15.6	525	207.8	896	17.3	1121
Michigan	1295	1297	49.4	2642	165.3	30.8	4.8	201	553.4	401	13.9	968	1094	923	18.3	2035
Total	1295	1297	49.4	2642	165.3	30.8	4.8	201	553.4	401	13.9	968	1094	923	18.3	2035

TABLE B-39

MUNICIPAL WATER SUPPLY

PLANNING SUBAREA 4.1

AREA IN STATE(S) OF : Michigan

(MGD)

	1970			1980			2000			2020	
GL	IS	GW	GL	IS	GW	GL	IS	GW	GL	IS	GW
	5033.0			**5799.2**			**7426.4**			**9569.6**	
4018.3	118.7	259.4	4802.6	110.0	250.0	6509.8	0.03	250.0	8703.0	30.0	200.0
675.4	19.9	43.6	829.3	18.7	43.7	1185.6	5.0	45.8	1665.7	5.1	39.3
810.4	23.9	52.3	995.1	22.5	52.4	1422.8	5.9	54.9	1998.7	6.2	47.2
*1013.1	29.9	65.4	1244.0	28.1	65.4	1778.5	7.4	68.6	2498.5	7.7	59.0
55.5	1.7	3.6	74.0	1.7	3.9	131.1	0.5	5.0	202.4	0.6	4.8
	107.9			**110.9**			**116.9**			**122.9**	
433.6	12.8	28.0	532.4	12.0	28.1	761.2	3.2	29.4	1069.4	3.3	25.2
43.4	1.3	2.8	53.3	1.2	2.8	76.1	0.3	2.9	106.9	0.3	22.5
241.8	7.1	15.6	296.9	6.7	15.6	424.4	1.8	16.4	596.3	1.8	14.1
12.1	0.4	0.8	20.7	0.2	1.1	55.0	0.2	2.1	95.5	0.3	2.3
*1200.0	29.9	65.4	165.3			553.4			1093.9		

Industrial Water Use

Manufacturing water withdrawals at present are about double the withdrawals for domestic and commercial uses. Total withdrawals for all manufacturing are estimated to have been 1.56 billion gallons per day in 1970, of which about 265 mgd or about 17 percent of the total was obtained from municipal water supply systems. This ratio of municipally supplied industrial water is quite high in comparison to the national ratio of less than 10 percent, and the overall Great Lakes Basin ratio of 11 cent.

There are two factors which may account for these differences. First, it is observed in Table B-40 that the category of industries that is included under "Other Manufacturing" accounts for the lion's share of value added by manufacturing. Although "other manufacturing" includes large water using establishments such as may be found in the automotive industry, the category is comprised mainly of industries with smaller water requirements that are more economically satisfied by purchase from municipal systems. Second, the concentration of industries in Wayne, Oakland, and Macomb counties with relatively limited frontage on Lake St. Clair and the Detroit River, and the lack of sizeable inland surface sources, provides few locations for the development of large individual industrial supplies. These circumstances will continue to influence industrial water supply development and it is expected that municipal water systems will provide even larger shares of the industrial water requirements of the future.

Lake St. Clair and the Detroit River are the principal sources of self-supplied industrial water in the Detroit metropolitan area. In the southeast counties, Lake Erie is the major source for industrial water supplies; in the northeast surface streams (such as the Raisin, Huron, and Rouge Rivers), Lake Huron and the St. Clair River provide the industrial water. Information on the quantities of water obtained from any of these sources is not available. Because of the relatively poor yields of ground water aquifers in this planning subarea, it is believed that industry-operated wells provide only a small part of the total industrial water used.

Table B-40 presents the base year estimates and projections of five water use parameters. The table also presents the constant dollar estimates of value added by manufacture for the five major water using SIC 2-digit industry groups and the residual manufacturing groups that comprise the manufacturing sector. The value added parameter is derived from OBERS projections and is included in the table to serve as an indicator of the rates of growth of the industry groups and sector. Also, the value added parameter is a key element in the water use projection methodology. The water use estimates represent the needs of all establishments without differentiating between small water users and large. The large water using establishments (those that withdraw 20 million gallons per year or more) are relatively few in number and probably do not exceed 300 factories, but the impact of their water requirements is huge. It is estimated that the 300 or so large water using establishments account for more than 97 percent of the total withdrawal needs of the manufacturing sector.

In addition to the concentration of the water use among these 300 plants, there is a further concentration of water use within particular industry groups. As may be seen in Table B-40, the largest water withdrawals in 1970 are found in SIC 33, the Primary Metals Industry Group, followed by SIC 28, Chemicals and Allied Products. Manufacturing establishments in these two groups accounted for 1149 mgd of the estimated total manufacturing withdrawals of 1562 mgd.

TABLE B-40

ESTIMATED INDUSTRIAL WATER USE, PLANNING SUBAREA 4.1
(mgd)

1970	SIC 20	SIC 26	SIC 28	SIC 29	SIC 33	Other Mfg.	Total
Value Added (Millions 1958$)	435	85	581	78	810	6696	8685
Gross Water Required	48	166	511	266	1204	438	2633
Recirculation Ratio	1.84	3.39	1.77	3.02	1.40	1.75	-----
Total Water Withdrawal	26	49	289	88	860	250	1562
Self Supplied	-----	-----	-----	-----	-----	-----	1297
Water Consumed	5.11	6.7	26	4.5	93.2	13	148
1980							
Value Added (Millions 1958$)	590	124	1018	98	999	9816	12,645
Gross Water Required	72	235	956	381	1379	649	3672
Recirculation Ratio	2.77	6.03	3.32	5.61	2.59	2.44	-----
Total Water Withdrawal	26	39	288	68	532	266	1219
Self Supplied	-----	-----	-----	-----	-----	-----	900
Water Consumed	6.7	9.3	48	6.7	106	19	196
2000							
Value Added (Millions 1958$)	1006	799	3230	215	1464	20,287	27,000
Gross Water Required	117	1320	3428	1079	1820	1402	9166
Recirculation Ration	3.15	8.00	11.7	19.61	9.63	4.80	-----
Total Water Withdrawal	37	165	293	55	189	292	1031
Seld Supplied	-----	-----	-----	-----	-----	-----	589
Water Consumed	11	52	170	20	138	39	430
2020							
Value Added (Millions 1958$)	1778	1413	8387	433	2228	43,210	57,449
Gross Water Required	193	2000	8910	2080	2400	3035	16,618
Recirculation Ratio	3.50	8.00	15.0	23.92	12.0	5.86	-----
Total Water Withdrawal	55	250	594	87	200	518	1704
Self Supplied	-----	-----	-----	-----	-----	-----	1092
Water Consumed	18	80	442	39	179	84	994

These withdrawals of water enabled manufacturers to meet their larger gross water requirement of 2,633 mgd in 1970 by recirculation and reuse of water at various rates within their plants. As may be seen in Table B-40, there are differences in present day estimated recirculation rates between the various industry groupings. It may be observed also that the recirculation rates of SIC 28 and SIC 33 are the lowest, although their gross water needs are larger than any of the other industry groups. For these two industry groups in particular, and all industries in general, reasonable improvements in recirculation rates can bring about dramatic reductions in the quantities of water that need to be supplied.

For the total manufacturing sector, the value added by manufacture is projected to increase from $8685 million (1958$) to $57,450 million (1958$) between 1970 and the year 2020. The gross water requirement to meet the year 2020 manufacturing requirements is projected to become 16,600 mgd, an increase of 630 percent over the gross water requirements of 1970. Without improvements in recirculation rates and other water management practices, the withdrawal requirements would increase correspondingly to over 8 billion gallons per day. However, improvements in the recirculation rates are forecast in this study to occur with the net results showing a slight decrease in total manufacturing withdrawals to the year 2000. After the year 2000 the withdrawals will increase to about 1,700 mgd by the year 2020.

Two industry groups, SIC 28 and 33 and the broad industry grouping under "Other Manufacturing" are most influential in the changing withdrawal requirements. SIC 28 has been forecast by OBERS to expand its production rapidly during the planning period for a net production increase of over 1400 percent. While we are projecting that the industry group will improve its recirculation rate from 1.77 in 1970 to 15.0 in 2020, this improvement does not keep pace with the growth in production. The net result is the forecast of an increase in the water withdrawal demands for SIC 28.

On the other hand, SIC 33 is projected to expand production more slowly. The improvements in recirculation by this industry group from 1.40 to 12.0 are more than sufficient to meet increasing water needs for the added production. The net result for SIC 33 is the forecast of a decrease in water withdrawal demands.

"Other Manufacturing" represents a large assortment of small and large industries whose sum total growth during planning period is forecast to exceed 640 percent. The potential for improvements in water reuse by these industries is believed to be not as great as for the SIC 2-digit industries.

The table also shows that consumption of water by manufacturing in the subarea will increase to about 1000 mgd. To place perspective on the size of this water loss, it may be recalled that the total present day domestic commercial withdrawal requirements for the planning subarea are only about 630 mgd. Three industry groups will account for 705 mgd of the water consumption. They are SIC 28, 442 mgd; SIC 33, 179 mgd; and other manufacturing, 84 mgd.

One additional comment on the projected water requirements concerns the broad industry category of "other manufacturing." Although this group includes other large water using industries, it is comprised mainly of the small establishments which obtain water from public systems. The growth of its withdrawal requirements from 250 mgd in 1970 to 518 mgd in year 2020 suggests that municipal systems can be expected to increase the quantity of their service to that sector.

Although the recirculation rates are shown to two decimal places in Table B-40, it is not intended to imply that the projection methodology is so precise and reliable. They are the numbers that resulted from the derivation formula and that were used for calculating demands. It is also unlikely that the improvements in recirculation will occur with the mathematical

regularity that the formula provides. For some industries improvements may occur at faster or slower rates in the early period and slack off or accelerate in later years; nonetheless, the general trends and net demands may be expected to occur in the planning subarea approximately as shown.

the quantity of intake water and the quantity discharged by the manufacturer. Since it determines only the consumption that occurs by use between the intake and outfall of the plant and does not account for evaporation that occurs in the receiving water as a result of heated waste discharges, the net depletion of the water resource will be somewhat larger than the quantities derived by this procedure.

Water consumption is closely correlated with the gross water requirement of industry, and the latter is related to industry output. From presently available information it appears that the consumption gross water correlation holds whether the gross water requirement is met by once-through use of water or by combination of reuse and new intake water. There is a likelihood that consumption will increase relative to gross water as the use of cooling towers for recirculating cooling water becomes more common, but the dimensions of the increase cannot now be estimated due to lack of data. Projections of consumption in Planning Subarea 4.1 are based, then, on constant relationships with gross water requirements for the individual industry groupings.

In manufacturing, water consumption includes water incorporated into products, and unaccounted losses such as may result from leaks, but by far the largest part of the consumption is the result of evaporation induced by the heat taken up by the water in its uses as a coolant and as a process water. The heat content of the water must eventually be dissipated until conditions within its immediate environment are met. Dissipation of the heat occurs within the plant by natural evaporation as well as by induced evaporation in cooling towers. In the receiving water, dissipation of the heat occurs by convection as well as evaporation.

In addition to the consumption of water by manufacturers, water is also consumed by thermal power generating plants and irrigated agriculture through evaporation and transportation. The combined consumption by these two uses plus manufacturing will result in vapor and associated heat energy emissions to the atmosphere at the next order of magnitude greater than exists at present. The implications to the hydrologic cycle, regional water resources and the environment in general of large releases of water vapor and heat energy are not now well known. It is possible that the net result will be undesirable.

Needs, Problems, Solutions[14]

Municipal

Table B-39 shows the projected need for additional water supply capacity in Planning Subarea 4.1 to be 1094 mgd in 2020. This capacity will be used to supply water needed for additional growth. All needs are projected as being met by withdrawals from the Great Lakes and their connecting channels.

Fully developed inland lakes and streams in Planning Subarea 4.1 have the potential for producing a sustained water supply yield of 1167 mgd. In addition, ground water aquifers in this area can produce 600 mgd. The water resource available in Planning Subarea 4.1, therefore, is adequate to meet the projected future requirements. The need exists only in the management and development of the water resource.

TABLE B-41

RURAL WATER USE

REQUIREMENTS AND CONSUMPTION

PLANNING SUBAREA 4.1

(mgd)

	1970	1980	2000	2020
REQUIREMENTS				
Rural Farm				
Domestic	4.1	3.3	2.4	2.5
Livestock	5.4	6.6	7.8	9.1
Spray Water	0.1	0.1	0.1	0.1
Subtotal	9.6	10.0	10.3	11.6
Rural Nonfarm	39.6	44.2	53.0	56.1
Total	49.3	54.2	63.3	67.7
CONSUMPTION				
Rural Farm				
Domestic	1.0	0.8	0.6	0.6
Livestock	4.9	5.9	7.0	8.2
Spray Water	0.1	0.1	0.1	0.1
Subtotal	6.0	6.8	7.7	8.8
Rural Nonfarm	5.9	6.6	8.0	8.4
Total	11.9	13.5	15.6	17.3

The estimated costs necessary for new construction to provide the projected municipal water supply needs by each of the target years are presented in Table B-42. All estimates are adjusted to January 1970 price levels. The costs include transmission of the water supply and water treatment, but do not include intra-urban distribution.

The cost estimates in Table B-42 are an estimate of the cost of meeting overall needs related to additional population growth. No attempt has been made to subtract costs of meeting needs which are within the scope of ongoing programs.

Presently the city of Detroit is engaged in a $110 million construction program which will result by 1973 in 400 mgd additional treatment facilities and an intake in Lake Huron with a design capacity of 1200 mgd.

In regard to intake capacity, the ongoing program will satisfy projected needs beyond the time period of this study. In regard to treatment, it should not be assumed that the 400 mgd of treatment capacity will be entirely additional to present capacity. In general, it is fair to say that a significant portion of any ongoing water supply development program may be devoted to replacement of existing facilities which have become obsolete, inefficient, or for some other reason not suited to the continued production of municipal water. In the case of this southeastern Michigan area, it is probable that a substantial portion of the present 400 mgd project's capacity will be devoted to replacement use.

Industrial

Water withdrawals by manufacturers in Planning Subarea 4.1 are estimated to be 1562 mgd in 1970. Although manufacturing production will continue to grow, the accompanying increasing gross water demand to meet the expanding output will be more than matched by the increasing reuse and recirculation of water in the manufacturing plants. As a result, total water withdrawals are expected to decline to about 1,000 mgd by late 1980's. Beginning about 1990, as maximum feasible recirculation rates are approached, the withdrawal demand will start to increase sharply to a total sector demand of about 1,700 mgd by the year 2020.

For the total manufacturing sector, output measured in value added by manufacture is projected to increase from $8.685 billion in 1970 to $57.449 billion in 2020. If it is assumed that existing manufacturing plants can enlarge their capacities at present locations by 100 percent to double the present value added by manufacture, then some $40 billion of manufacturing activity will be occurring at new plants in new locations for which new supplies must be developed.

TABLE B-42

ESTIMATES OF COST INCURRED FOR THE DEVELOPMENT OF MUNICIPAL WATER SUPPLY FACILITIES TO MEET THE PROJECTED NEEDS

Planning Subarea 4.1

(million $)

SOURCE	COST	1970-1980	1980-2000	2000-2020	1970-2000	1970-2020
Great Lakes	Capital	49.424	116.041	161.609	165.466	327.076
	Annual OMR	2.462	10.708	24.544	13.171	37.716
	Total OMR	24.629	214.172	490.895	238.802	729.697
Inland Lakes and Streams	Capital	.000	.000	.000	.000	.000
	Annual OMR	.000	.000	.000	.000	.000
	Total OMR	.000	.000	.000	.000	.000
Ground Water*	Capital	.000	.000	.000	.000	.000
	Annual OMR	.000	.000	.000	.000	.000
	Total OMR	.000	.000	.000	.000	.000
Long Distance Transport of Great Lakes	Capital	164.506	88.000	95.000	252.500	347.500
	Annual OMR	5.600	3.000	3.200	8.600	11.800
	Total OMR	56.000	60.000	64.000	116.000	180.000
Total	Capital	213.925	204.042	256.610	417.967	674.576
	Annual OMR	8.063	13.709	27.745	21.772	49.516
	Total OMR	80.63	274.173	554.895	354.802	909.700

* Ground water unit cost assumptions are as follows:

	Capital ($/mgd)	Annual OMR ($/mgd-yr)
transmission	120,000	7,600
wells and pumping (see Figure 6-4)	-	-
total	120,000	7,600

The problem associated with meeting those new withdrawal needs and the range of their solutions will be strongly influenced by other planning goals, such as land use, environmental quality, sub-regional economic development, and the availability of the water supply and facilities for its return to the resource base. Undoubtedly, much of the new industrial development will occur in the counties that are inland from the lakeshore if sufficient water supply is available. The inland dispersal of new industries can be encouraged and the management of the water resource can be achieved best by the enlargement of municipal systems and or the development of regional supply systems to provide the industrial water through the development of local sources and the transfer of large quantities from Lake Huron, Lake Erie and the interconnecting river-lake system.

EFFECTS OF POLLUTION

Lake Erie

The "Statement on Lake Erie" prepared by the U.S. Bureau of Commercial Fisheries, Department of Interior, Ann Arbor, Michigan, and presented at the Lake Erie Enforcement Conference on 3 June 1970 contained an excellent summary of some of the problems associated with the fishery and acquatic habitat of Lake Erie. Excerpts from this report follow which indicate the magnitude of the problem we face.

"Based on an analysis of available data the following conclusions are drawn concerning the past, present and future status of the commercial and sport fishery and related acquatic resources of Lake Erie:

1. Lake Erie has been the most fertile and productive of all the Great Lakes. The value of the catch is declining, however, which reflects the changing conditions of the fish stocks from high-value to low-value species. High-value species like the sturgeon, northern pike, whitefish, cisco, blue pike, and sauger, have virtually disappeared from the catch. Walleye, yellow perch, white bass, and channel catfish constitute the major remaining species of higher and medium value. These species are declining and show signs of difficulty in perpetuating themselves. Stocks of such less valuable species as freshwater drum, carp, suckers, and goldfish are, with few exceptions, greatly underexploited.

2. By most criteria accepted by limnologists, Lake Erie is classified as a eutrophic lake with changing water quality in both inshore and open waters. Industrial, municipal, and agricultural pollution and enrichment of Lake Erie has caused: (a) massive nuisance and toxic algae blooms of Microcystis and Aphanizomenon, (b) destruction of the valuable mayfly benthos in the western and central basins, (c) a 20-fold increase in plankton, the diet staple for several nuisance and low-value fishes that have undergone population explosions in the last 15 years, (d) increased levels of such pesticides as DDT and Dieldrin in fish flesh, (e) dangerously high levels of mercury in many fishes, (f) the destruction of spawning areas of some of our most valuable fishes, and (g) disappearance of oxygen from the bottom waters of the central basin during the summer.

3. The concentration of dissolved solids is still well below levels directly lethal to fish and food organisms even though solids have increased by 50 ppm since 1920. However, the continued accelerated rate of increase is cause for future concern.

4. Warm water temperatures and high nutrient levels have led to tremendous algae blooms. This organic production has created in turn a large BOD during decomposition. Furthermore, reduced materials have accumulated in the sediments over the years. The combined BOD and chemical oxygen demand from these two phenomena have caused widespread oxygen depletion in the bottom organisms so important in the diet of many Lake Erie fishes. Any increase in nutrient levels or average water temperatures will undoubtedly worsen this situation.

5. Pesticides, heavy metals such as mercury, phenols, cyanides, acids and exotic inorganic chemicals are among the many outright pollutants discharged into Lake Erie. Pesticide levels (DDT and Dieldrin) are moderately low in Lake Erie fishes and all fall safely under the 5.0 ppm level set by the FDA. Mercury levels are, on the other hand, dangerously high. Values in some walleyes and white bass especially have exceeded the action level of 0.5 ppm set by the FDA.

6. Observations on walleye reefs during the 1969 spawning season suggest that the smothering effect of sedimentation on fish eggs and other bottom associated organisms may be detrimental and a major factor in the decline of some of our valuable fish stocks. Obviously, increasing siltation is a serious problem that needs full attention by the appropriate agencies now.

The public Health Service in its 1965 report on the Michigan Waters of Lake Erie outlined two major zones of pollutions--one in the vicinity of the mouth of the Detroit River, and one near the mouth of the Raisin River. These waters are polluted bacteriologically, chemically, physically and biologically; they contain excessive coliform densities, suspended solids, nitrates, ammonia, organic nitrogen and phosphates, and sludge deposits. Bacteriological densities in Lake Erie from the mouth of the Detroit River to a point 2-3 miles to the south are such that the water cannot be safely used for recreational purposes. Cyanides were found at the mouth of the Raisin River and at Sterling Park in concentrations exceeding Public Health Service drinking water standards. Over 85 percent of the Michigan waters of Lake Erie contain inorganic nitrogen and soluble phosphates in excessive concentrations. Algal blooms have resulted and the city of Monroe has already been forced to move its water supply intake to avoid objectionable tastes and odors from algae.

As reported in the Limnology Appendix of the Great Lakes Basin Framework Study, changes in the occurrence or abundance of an organism is generally regarded as the most sensitive measure of environmental changes. Several undesirable changes have been reported in Lake Erie since 1953 including large scale deaths among the burrowing mayfly nymphs, an increase in turbificid worm (sludge worms), population densities and increases in several species of finger nail clams. These changes were regarded as indicators of increasing pollution in the western basin of Lake Erie.

Other problems in Lake Erie were reported in the "Lake Erie Report" by the Federal Water Pollution Control Administration. Nutritional overaging now taking place in Lake Erie. Much of the nutrient problem originates from municipal and industrial wastewater. Desirable game and commercial fish, which are not pollution tolerant, such as cisco, blue pike, and walleye, have disappeared or declined drastically while the less desirable fish have increased sharply.

The other large problem in Lake Erie is that of bacterial contamination. Bacteria levels near the large metropolitan centers such as Detroit, Cleveland, Toledo and Buffalo have been and continue to be a direct health hazard.

By international treaty and by common sense we are committed to make an all-out effort to keep the boundary waters of the Detroit River and Lake Erie in a condition that it remains

RIVER BASINS

The following Table B-43 is a summary of water quality of river basins for Southeastern Michigan.

TABLE B-43

Basin	General Conditions	Causative Factors
River Raisin	Surface water high in nutrients dissolved and suspended solids with concentrations increasing toward mouth of river.	Raw. Primary and Secondary sewerage out falls. Industrial out falls.
Huron River	Suspended solids lower than River Raisin, total dissolved solids and chlorides are moderate. Over-enrichment a major problem and wide spread. Maximum phosphate concentrations in Ann Arbor - Ypsilanti Area.	Raw, Primary, Secondary sewerage out falls. Industrial and Stormwater out falls.
Detroit River	High coliform densities and iron concentrations from Lake St. Clair to Rouge River. Touge River to Lake Erie - Excessive levels of coliforms, phenols, toxic substances, nutrients, suspended solids residues with objectionable color, oil and debris present.	Combined sewer overflows. Industrial and commercial out-falls, River Rouge entrance to Detroit River
Rouge River	Upper Main Rouge, high in coliforms, suspended solids moderate with dissolved solids high with general nutrient enrichment.	Industrial outfall combined sewer outfalls
	Lower Main Rouge, excessive levels of dissolved oxygen, coliforms, nutrients, suspended and dissolved solids.	Combined Sewer outfalls-Industrial outfalls
	Lower Rouge, Middle Rouge, Upper Rouge, high dissolved oxygen and coliform densities with nutrients levels high.	Industrial out fall septic tank, raw sewerage and combined sewerage out fall.
St. Clair River and Lake St. Clair	St. Clair River Excellent Condition Lake St. Clair is of good quality at St. Clair River discharge. High coliform, nutrients and minerals at Clinton River Discharge	Sewer treatment outfalls along Clinton River
Clinton River	The river basin has high nutrient concentrations, coliform densities with dissolved oxygen level low.	Municipal treatment plant outfalls and combined sewer outfalls.
Belle, Black Pine Rivers	Good quality through out the basins except at outfalls of combined sewer, industry and municipal sewage treatment plants	Combined sewer, industry and sewage treatment outfalls.

useful to both nations. Article 4 of the Boundary Water Treaty stipulated that "boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other side." As evidenced by the beach contamination on the U.S. side of Lake Erie, a health hazard does exist.

Water Quality Standards

The water quality standards for the State of Michigan are shown in Exhibit A. Exhibit B shows the water quality standards for designated use areas.

ST. CLAIR RIVER - LAKE ST. CLAIR, DETROIT RIVER - LAKE ERIE, MAUMEE RIVER BASIN

DESIGNATED USE AREAS

EXHIBIT B

The water quality standards for the designated use areas shall not apply during periods of authorized dredging for navigation purposes and during such periods of time when the after-effects of dredging degrade water quality in areas affected by dredging. (Water quality standards for the designated use area shall apply in areas affected by the disposal of spoil from dredging operations).

Where the waters are classified under more than one designated water use, it is intended that the most restrictive individual standard of the designated water uses shall be adhered to.

In areas adjacent to outfalls, standards for the designated water use or uses shall apply after admixture of waste effluents with the public waters but in no instance shall the mixing zone act as a barrier to fish migration or interfere unreasonably with the designated water use or uses for the area. The Water Resources Commission must have discretion in determining the extent of the mixing zone. In general, the Water Resources Commission encourages the use of outfall structures which minimize the extent of the mixing zone.

Based on their existing uses and reasonable future uses the waters of the St. Clair River, Lake St. Clair, Detroit River and Lake Erie will be protected as described below.

1. All the above named waters will be protected for Water Supply--Domestic, except that portion of the Detroit River from Point Hennepin to the mouth. The individual parameters shall be measured at the point of water withdrawal.

2. All the above named waters will be protected for Water Supply--Industrial. The individual parameters shall be measured at the point of water withdrawal.

3. All the above named waters, except at the mouths of tributaries, in the immediate vicinity of enclosed harbor areas and in the immediate vicinity of water treatment plant outfalls will be protected for Recreation--Total Body Contact; except for conditions regulating the natural causes.

4. All the above named waters will be protected for Fish, Wildlife and Other Aquatic Life--Warm Water Sport Fish.

5. All the above named waters will be protected for Commercial Navigation in the designated navigation channels as maintained by the U.S. Corps of Engineers.

Table B-43 shows the water quality degradation of River Basins and Surface Waters by the standards set forth in Michigan and Federal Government standards.

International standards or objectives which the International Joint Commission has established are stated in "Water Quality Objectives for the Receiving Waters of Lake Erie, Lake Ontario, the International Section of the St. Lawrence River and the connecting channels of the Great Lakes." These objectives have been agreed to by commission members of both nations. The general objectives are similar to those accepted in the interstate standards, but the specific objectives are generally more demanding than the interstate standards for domestic water supply. These recommendations are listed in the report "Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River", 1970, by the International Joint Commission.

CURRENT PLANS

INTRODUCTION

As in other older regions of the nation, water quality management for a number of years has been a common concern of both operating and planning agencies in southeastern Michigan. With the progressive raising of water quality standards by both the federal and state government, plans for the improvement of water quality, largely in terms of more adequate wastewater treatment, have moved forward. A number of agencies are involved in the development and accomplishment of such plans in the region.

The major operating agency in Southeastern Michigan is the Detroit Metropolitan Water Department (DMWD), which contracts to treat sewage for some 60 suburban communities and the City of Detroit. This agency has developed plans for the improvement and expansion of its sewerage services. These plans are subject to review by SEMCOG, in accordance with the A-95 clearing house procedure, and to approval by the Michigan Water Resources Commission (WRC), before federal grants-in-aid are provided. Likewise, the Wayne County Road Commission, through its division of public works, operates certain sewage collection and treatment services to both Washtenaw County and Oakland County. Such plans are likewise subject to review by SEMCOG and approval by the WRC, before funding at the federal level. Within its area, the Oakland County Department of Public Works has developed a wastewater treatment plan and is actively engaged in establishing the treatment plants and interceptor sewers necessary to accomplish this plan. The Macomb County Drain Commission, the Monroe County Drain Commission and the Washtenaw and St. Clair County Departments of Public Works are all engaged in the development and construction of wastewater collection and treatment plans.

SEMCOG, in accord with its enabling legislation and under HUD and EPA regulations, is responsible for the development and adoption of a region-wide wastewater treatment plan. Such a regional plan was presented to HUD by SEMCOG in November 1971, and adopted by the General Assembly of SEMCOG in January, 1972.

At the same time, under federal law, the Michigan Water Resources Commission is responsible for the development of a State Wastewater Treatment Plan. This agency has been actively engaged in the formulation of that part of the state plan dealing with Southeastern Michigan. Currently, the Southeastern Michigan plan for wastewater treatment approved by

the WRC and adopted by SEMCOG is before the EPA for consideration. The plan is titled, "Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plans."

The following material is drawn largely from the SEMCOG Plan, and presents the situation and plans for each of the six counties.

COUNTY PLANS

St. Clair County[16]

St. Clair County is represented by four wastewater plans:

(1) Interim Water Quality Management Plan for the Southeast Michigan Metropolitan-Regional Area, WRC, March 1972.

(2) Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plans, SEMCOG,1972.

(3) Pollution Control Program for the Detroit Regional Watershed, DMWD, 1966.

(4) County Sewer and Drainage Study St. Clair County, Michigan. In essence, the St. Clair County, WRC and SEMCOG plans are in agreement. Each plan provides for six treatment plants located at Port Huron, Marysville, St. Clair, East China, Marine City and Algonac beyond 1990. The DMWD Plan has one regional plant with its collection system after the year 2000.

The following statement of existing conditions and recent studies for St. Clair county is taken from SEMCOG. "St. Clair County has retained consulting engineers to prepare a short-range and long-range plan for sewers and sewerage treatment in that county. The report entitled County Sewer and Drainage Study St. Clair County, Michigan, was published in 1969. Six alternate plans were presented in detail for the urban and urbanizing areas adjacent to Lake Huron, the St. Clair River and Lake St. Clair. It was determined that New Baltimore would be eventually served by an interceptor from Macomb County and would not be a part of the St. Clair County plan.

The report recommended that ultimately there should be three treatment plants (Port Huron, East China Township, and Algonac) to serve the urbanized shoreline in the areas adjacent to Lake Huron, St. Clair River, and Lake St. Clair, but that this plan would not be implemented before the year 1990. It was recommended that all construction during the interim period be planned for the ultimate three-plant system. This official Pollution Control Plan was filled with the State Water Resources Commission in 1969, and adopted by the County."

St. Clair County 1980 Short-Range Program Summary

"The Michigan Water Resources Commission has cited 8 townships in St. Clair County for contributing to pollution of Lake Huron, St. Clair River and their tributaries. They are the Townships of Burtchville, Fort Gratiot, Port Huron, Kimball, St. Clair, Cottrellville, Clay and Ira. This event is expected to spur action by these communities to construct sanitary sewerage collection and treatment systems, with higher quality wastewater treatment at established treatment plants. To meet water quality standards already adopted, the following list of communities have been ordered to provide secondary treatment facilities by June 1, 1972 and phosphate removal by June 1, 1977. Port Huron is currently underway with construction for secondary treatment while Marysville, St. Clair, Marine City and Algonac are still under order to do so. Consequently, the 1970's will be a period of major expansion for the county.

The St. Clair County Department of Public Works is an agency equipped to assist these communities and has the authority under Act P.A. of 1957 to contract with civil divisions to acquire, construct and operate sewer systems and disposal systems in the County. They are doing this now as indicated by the Clay-Ira project. At the present time St. Clair County DPW is planning several projects which will be built in the near future. (Two in St. Clair and one each for Fort Gratiot and Port Huron Townships.) One such project will be the construction of six miles of a sanitary sewer interceptor system from the east boundary of Ira Township through Clay Township to the County-operated wastewater treatment plant at Algonac.

This project will provide service to both Ira and Clay townships. During the next five years, the interceptor will be extended westerly in Ira Township to approximately the New Baltimore City line. An interceptor will be constructed in Clay Township west and north of the City of Algonac. The treatment plant at Algonac, will be expanded and upgraded during the next 2 years.

The Marine City sewage treatment plant originally built in 1954 is under contract to be expanded and upgraded by the City during the next two years. The plant will provide service to Cottrellville Township south of the City. An interceptor sewer will be constructed by the County DPW south along the St. Clair River to Algonac State Park.

A system of sanitary sewers will be constructed by the County DPW to service St. Clair Township in the populated areas along State Highway M-29 between St. Clair and Marysville. The sewers will carry flow both north and south to the treatment plants in St. Clair and Marysville. Each of the plants in Marysville and St. Clair will be upgraded and expanded. The Marysville plant will provide service to a portion of Kimball Township. The sewers in Kimball Township will be constructed by the County DPW.

The East China Township treatment plant will be expanded and updated during the next five years. The plant was originally constructed in 1954 and expanded in 1961 and 1968. The 1968 expansion included secondary treatment and an increased capacity of 1.50 MGD. The plant was acquired by the County in 1968 and, after expansion was leased back to the township for operation. The sewer system of the township is also owned by the County and has been leased back to the township. Eventually this plant will be abandoned and a new regional plant constructed to service Cottrellville, China, East China and St. Clair Townships and the cities of Marine City and St. Clair. It is anticipated that the new plant will not be constructed before 1990.

An extensive system of sewers will be constructed in Port Huron Township during the next ten years by the County Department of Public Works. The sewers will connect to the City of Port Huron system and thence to the Port Huron treatment plant.

The Port Huron City Master Sewerage Plan and Capital Improvement Program calls for the Port Huron treatment plant to be expanded and phosphate removal facilities added. The Port Huron plant will be one of the three regional plants in St. Clair County. The County DPW will construct a system of sewers in Fort Gratiot Township which will be connected to a proposed interceptor constructed by the City from the Port Huron treatment plant north through Port Huron to the City limits. From the City limit to the Burtchville Township line the sewer will be built by the County. Burtchville Township has chosen to remain independent from all outside systems.

It is anticipated that sewage lagoons will provide treatment during the next ten years for the Villages of Yale, Capac and Memphis. During the ten-year period the treatment plant in New Baltimore will be phased out and the system will be connected to the Macomb County interceptor system operated by the City of Detroit. Burtchville and Kimball Townships have been cited but no action has been actually planned for 1990 by anyone other than the county plan."

St. Clair County 1990 Long-Range Program Summary.

"During the decade from 1980 to 1990 an interceptor sewer will be extended underneath the North Channel of the St. Clair River to service Harsens Island. This interceptor and those constructed on the island will be built by the County DPW and the sewage treated in the County-owned Algonac treatment plant.

The City of Marysville will expand the interceptor system in the city to permit additional areas of Kimball and St. Clair Townships to be served by the City.

The County DPW will extend an interceptor along State Road in Fort Gratiot Township northly to Cole Road.

It is not anticipated that there will be any expansion of treatment plants during this ten year period because expansions of the plants during the 1970's are designed to serve up to the year 1990. Shortly after 1990 it is planned to phase out the treatment facilities in Marine City, East China Township and St. Clair and convert these plants to pump stations which will pump to a new plant to be built in East China Township. The treatment plant in Marysville will also be converted to a pumping station which will pump to the City of Port Huron plant.

The villages of Yale, Capac and Memphis will continue to be served by their individual treatment plant beyond the year 1990."

MACOMB COUNTY[16]

Macomb County is represented by four wastewater treatment and collection plans:

(1) Interim Water Quality Management Plan for the Southeast Michigan Metropolitan-Regional Area, WRC, March 1972.

(2) Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plans, SEMCOG, 1971.

(3) Pollution Control Program for the Detroit Regional Watershed, DMWD, 1966.

(4) Wastewater - Collection and Disposal System, Macomb County

The WRC, SEMCOG and DMWD (See Fig. E-1) plans are in agreement that the Warren Plant will become part of the Detroit Regional System; while a system of interceptors will be built to service all of Macomb thru the regional system of DMWD.

The following statements of existing conditions and recent studies for Macomb County are taken from SEMCOG.

"Macomb County retained a consulting engineering firm to recommend a course of action for that county. The report entitled Waste Water - Collection and Disposal System Macomb County was published in 1966. One alternate plan studied, but rejected, offered one sewerage treatment plant to be built in Macomb County to service all of the county except East Detroit, St. Clair Shores and Roseville, which are now connected to the Detroit Metropolitan system. The consultants recommended that a system of interceptor sewers be constructed and connected to the Detroit system which would service all of the urban and urbanizing areas of the county. That plan would eliminate all treatment plants in Macomb County.

In essence, the St. Clair County, WRC and SEMCOG plans are in agreement. Each plan provides for six treatment plants which would be located at Port Huron, Marysville, St. Clair, East China, Marine City, and Algonac thru 1990. Beyond 1990, each plan provides for three treatment plants which would be located at Port Huron, East China and Algonac. After the year 2000, the DMWD plan has one regional plant with its collection system.

Macomb County 1980 Short Range Program Summary

"The Detroit Metro Water Department is the agency constructing a system of regional interceptors in Macomb County. This system of interceptors will ultimately service the entire County of Macomb and a large area of Oakland County. With the completion of the Corridor Interceptor of the Oakland-Macomb Interceptor system in 1972 the City of Warren treatment plant should be phased out and the Warren system connected to the Corridor Interceptor. All Sections of the Oakland Arm are completed. Thus, the City of Sterling Heights and the City of Utica can abandon their treatment plants and connect to the interceptor. The interceptor will also be available to Shelby Township and the sewer system of that township may be connected to the regional interceptor system.

The Romeo Arm has been completed along Garfield Road in Clinton Township up to the Clinton Township Treatment Plant No. 2. This will permit the abandonment of the plant and the connection of the service area to the Romeo Arm.

The Romeo Arm will be extended during the coming ten-year period to 23-Mile Road in Macomb Township. This extension will provide service to the northeast corner of Sterling Heights, the northwestern portion of Clinton Township; to a major portion of Shelby Township and to the southwest corner of Macomb Township. The Romeo Arm will be constructed along the township line and Hayes Ave., the border road between Shelby and Macomb Townships.

The 15-Mile Road Interceptor from Garfield Road to Union Lake Road is under contract. When this line, which will be a five-foot diameter force main, and the Harper-Fifteen Pumping Station are completed in 1973 the Clinton Township plant No. 1 at Harper Avenue and Shook Road will be eliminated.

The Lakeshore Interceptor is under construction. It will be completed by Henry B. Joy Road in early 1974. This construction will provide service for all of Harrison Township, an area in the northeast corner of Clinton Township, and portions of Chesterfield Township. This interceptor will make it possible for the treatment plant at Metropolitan Beach and Selfridge Air Force Base to be abandoned and for the adjoining service area to be connected to the Harrison Township system. The City of Mt. Clemens treatment plant will be closed and the system will be connected to the Lakeshore Interceptor.

In the decade before 1980 the Lakeshore Interceptor will be extended to William P. Rosso Road. The Armada Arm will also be constructed west along Hall Road and north along North Road to 24-Mile Road. The Richmond Arm will be constructed east in William P. Rosso Road and thence along Anchor Bay in Jefferson Avenue to the City of New Baltimore. The construction of these two arm segments will provide service to the southeast corner of Macomb Township and all of Chesterfield Township. It will permit the abandonment of the New Baltimore treatment plant and the elimination of the Chesterfield Township Wastewater treatment lagoons at the intersection of 21-Mile Road and the I-94 Expressway.

The Romeo, New Haven, Armada and Richmond treatment plants will continue to serve their respective communities until sometime in the 1980-1990 decade."

Macomb County 1990 Long Range Program Summary

"In the decade between the years 1980 and 1990 the Romeo Arm will be extended in Hayes Road from 23-Mile Road to 29-Mile Road. That construction will provide service extensions into the southeastern area of Washington Township, the northeast area of Shelby Township and the northwest area of Macomb Township.

The Armada Arm will be extended from the City of New Baltimore to the village of New Baltimore to the village of New Haven. That extension will permit the closing of the New Haven treatment plant and the connection of the sewer system of the village to the interceptor.

The Romeo, Armada and Richmond treatment plants will continue to service their respective communities because it is anticipated that the regional interceptors will not reach those areas until sometime after the year 1990."

OAKLAND COUNTY[16]

Oakland County is represented by five wastewater treatment and collection plans:

(1) Interim Water Quality Management Plan for the Southeast Michigan Metropolitan-Regional Area, WRC, March 1972.

(2) Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plans, SEMCOG, 1971.

(3) Pollution Control Program for The Detroit Regional Watershed, DMWD, 1966.

(4) Hannan Road Arm of the Huron River Sanitary Interceptor System, Wayne County Road Commissioners, 1967.

(5) Water Pollution Control, Pontiac, Michigan, May 1970.

The WRC Plan provides for the connection of Avon, Oakland, Orion and Oxford Townships and related villages, to the Paint Creek Macomb Interceptor, and for the connection of Independence, Waterford and Pontiac Townships and related communites to the Clinton-Oakland Interceptor system. The DMWD and SEMCOG plans are in general agreement with the WRC plan. Each plan recognizes that the City of Pontiac treatment plant should remain independent of regional wastewater system.

The following statements of existing conditions for Oakland County are taken from SEMCOG.

"In November 1967 a report entitled Hannan Road Arm of the Huron River Sanitary Interceptor System was published by the Board of County Road Commissioners of Wayne County, Michigan. The Board of Commissioners proposed to construct a regional treatment plant at the mouth of the Huron River and an interceptor sewer along the river to the Washtenaw County line.

The proposed interceptor system would service 323 square miles of western Oakland County, an 85 square mile portion of Washtenaw County and a 39 square mile portion of the northwestern area of Wayne County. The proposed Hannan Road Arm and its branches would utlimately eliminate the existing local treatment plants and one interim plant under construction in the City of Novi in Oakland County.

The City of Pontiac retained the services of consulting engineers to prepare a detailed report for the city to determine the extent of expansion and upgrading of its two treatment plants. The report is entitled Water Pollution Control, Pontiac, Michigan dated May 1970. The report recommends that the City of Pontiac remain independent of the Oakland County System."

Oakland County 1980 Short Range Program Summary

"The County Department of Public Works will construct a section of the Stony Creek Arm of the Clinton-Oakland Interceptor during the decade before the year 1980. This arm is in the extreme east side of the County and for approximately one-half of the distance will be adjacent to the county line. The first section will run from its junction with the Clinton-Oakland

Interceptor at the Clinton River up to Buell Road in Oakland Township. This arm will service the extreme northeast area of Avon Township and will permit service to almost all of the balance of Oakland Township not served by the Paint Creek Interceptor. The area remaining without service is the extreme northeast area of the township.

The County DPW will construct the East Arm up to the White Lake Township Line and White Lake Branch of the Huron-Rouge system. The East Arm is an extension of the Main Arm of the Hannan Road Interceptor of the Huron River Sanitary Interceptor system. The East Arm generally follows the Walled Lake Branch of the Middle River Rouge up to Walled Lake in the City of Novi. From the Novi-Commerce Township line the East Arm runs directly north through the center of Commerce Township to Oakley Park Road. From that point on north to the White Lake Township line the route generally follows the Huron River.

The construction of the East Arm will permit the abandonment of the interim treatment plant now under construction in the north central part of the City of Novi near Walled Lake. The service area of the treatment plant in the City of Novi and the cities of Walled Lake and Wolverine Lake will be connected to the interceptor. Approximately seven square miles in the southwest area of the City of Novi will remain unsewered. Construction of the east arm will provide sewer service to all of Commerce Township except the northwest one fourth of the township.

The White Lake Branch Interceptor follows the Huron River through the Township of White Lake. It will provide sewer service to all of the township except the extreme northwest and southwest corners. It also will provide a service outlet for the south one-third of Springfield Township.

The wastewater treatment plants in the City of Wixom, and the Villages of Milford and South Lyon will continue to be operated and service their respective communities. The treatment plant in Holly has applied for expansion of treatment and will continue to serve the Village until approximately the year 2000.

The City of Rochester treatment plant will be phased out early in the decade and the system connected to the Clinton-Oakland Interceptor.

The County DPW will continue to construct a large number of collector and trunk sewers."

Oakland County 1990 Long-Range Program Summary

"The Oakland County DPW will construct the section of the Stony Creek Arm from Buell Road in Oakland Township to Leonard Road in Addison Township in the 1980-1990 decade. That extension will provide service to about one-third of Addison Township in the central and southeasterly area.

The County DPW will construct the balance of the Huron-Rouge Sewage Disposal system of interceptors during the 1980-1990 period. The East Arm, will be constructed from its junction with the White Lake Branch at the Clinton River in White Lake Township, easterly and northerly through Waterford Township to the intersection of Walton and Clintonville Roads as a relief sewer for the upper end of the Clinton-Oakland Interceptor system. All of the flow from the branches of the Clinton-Oakland Interceptor upstream from this junction point will be diverted to the East Arm. The Elizabeth Lake Road Arm along Elizabeth Lake Road will be constructed if needed as a relief to divert flow from the Clinton-Oakland system upstream from the junction with the Elizabeth Lake Road Arm will divert flow from approximately one-third of West Bloomfield Township, practically all of Waterford Township.

Independence Township and almost one-third of Orion Township. Depending on the Development of flows, this "relief)) may be deferred until after 1990.

The West Arm will follow the Huron River, from the East-West Arm junction in the center of Commerce Township, through Commerce and Milford townships to the Livingston County line approximately one-half mile south of the Milford Township line. The West Arm then runs south along the county line to the Washtenaw County line. The West Arm will be constructed through the village of Milford. Therefore the treatment plant for the village will be eliminated with the connection of the sewer system to the interceptor. The section of the West Arm along the Livingston County line will provide service to the Village of South Lyon. The construction of that section will eliminate the need for the South Lyon treatment plant.

The Norton Creek Branch will run southeast from its junction with the West Arm along Norton Drain to the City of Wixom wastewater treatment. The construction of that branch will eliminate the Wixom treatment plant.

The Pettibone Creek Branch will extend from its junction with the West Arm in the Center of thevillage of Milford northerly through Milford Township and to the center of Highland Township and thence easterly to White Lake. That project will provide sewer service to all of Highland Township and two small areas in the west side of White Lake Township. The West Arm, the Norton Creek Branch and the Pettibone Creek Branch will insure interceptor service for all Milford Township.

The Davis Creek Branch is an east-west branch of the West Arm through the center of Lyon Township. It terminates at the east township line at the junction of Eleven Mile Road and Napier Road. That branch will provide interceptor service for a sewer system to serve all of Lyon Township.

The village of Holly treatment plant will continue to serve the Village of Holly during the 1980-1990 decade, with expansion.

WAYNE COUNTY[16]

Wayne County has been represented by numerous plans over the years but DMWD and Wayne County Department of Public Works plans have been the dominate plans for the area.

Generally the program for the area is to extend the Detroit plant to serve all of Macomb County, City of Detroit and a large area of central and eastern Oakland County. Also a major plant at Huron River is to be added along with the Wyandotte plant, which is to be expanded and upgraded.

The following statement of existing conditions and recent studies for Wayne County is taken from SEMCOG.

"The major part of Wayne County is serviced by the City of Detroit and the Wayne County Department of Public Works through a system of interceptor sewers; the City of Detroit's treatment plant near the mouth of the River Rouge and the County's Wyandotte plant. There are also six minor plants and a small sewage lagoon in operation in the county. The County operates a plant in each of the cities of Trenton, Flat Rock and Rockwood. However the plant does not serve the city's sanitary system. Trenton operates a plant for its exclusive use. Riverview operates a local treatment plant which includes secondary treatment and discharges effluent into the Detroit River. A plant serving Grosse Ile is operated by the Wayne County Drain Commissioner, and Brownstown Township operates two small sewage lagoons.

There have been numerous reports over the years which have culminated in plans to expand the Detroit plant to serve approximately one-half of Wayne County including the City

of Detroit, all of Macomb County and a large portion of Central and eastern Oakland County. The Wyandotte plant is being expanded to service most of the middle third of the county. A new major plant is planned to be located at the mouth of the Huron River. It will serve parts of Monroe, Wayne, Washtenaw and Oakland Counties. Major interceptors leading to these plants are also planned."

Wayne County 1980 Short Range Program Summary

"The entire Huron River Sanitary Interceptor System within Wayne County and the secondary treatment plant at the mouth of the Huron River is planned for completion by 1975. This system includes: 1) a secondary treatment plant with phosphate removal at or near the mouth of the Huron River; 2) an outfall several miles out into Lake Erie; 3) The Huron River interceptor to the junction with Van Buren Arm and Hannan Road interceptor; 4) the North Arm; 5) the Novi Branch; and 6) the Van Buren Arm to the Washtenaw County Line. The initial capacity of the plant will be 60 MGD.

The Canton and Salem Inter-county branches of the Huron Valley Wastewater Control System will be constructed to serve Wayne County and Washtenaw County Communities within the early part of the decade.

By 1973 the Wayne County DPW Wyandotte Wastewater Treatment Plant will be expanded to a capacity of 100 MGD and will include secondary treatment and phosphate removal.

The Wayne County Trenton Plant will be expanded and upgraded to provide additional service to Brownstown Township and the Cities of Gibraltar and Woodhaven. Toward the middle of the decade the treatment plant will be phased out and the area will be served by the new Huron River Treatment Plant, via the proposed Trenton Interceptor.

The Riverview treatment plant will be phased out early in the decade, and the system serving Riverview will be connected to the Wyandotte Plant, via existing interceptors.

The City of Trenton and Township of Grosse Ile treatment plants will be taken out of service and the systems of each of the communities will be connected to the Huron River Treatment Plant via the proposed Trenton Interceptor.

The City of Rockwood and the City of Flat Rock treatment plants are being expanded and upgraded. They will continue to serve their respective communities until the Huron River Interceptor is completed and placed in operation in the mid-1970's.

The Trenton Sanitary Interceptor will be constructed during the first half of the decade to transport wastewater from Trenton, Woodhaven, Grosse Ile, Gibraltar and Brownstown Township to the Huron Plant. This interceptor will also serve as the first part of the Rouge-Downriver-Huron Flow Equalizing System.

The Rouge-Downriver Interceptor connecting the Rouge Valley-Oakwood Interceptor System and the proposed Trenton Interceptor will be constructed toward the latter part of the decade. This interceptor will serve to divorce the separated sanitary sewer systems of western Wayne County from the combined sewer systems of eastern Wayne County and deliver the relatively smaller volume but more concentrated wastewater from the separate systems to the Wyandotte and Huron Plants which are primarily designed to treat this type of wastewater. This interceptor will also serve as the second part of the Rouge- Downriver-Huron Flow Equalizing System.

The Trenton Interceptor and the Rouge Downriver Interceptor will be sized, located and instrumented to equalize flow between the Wyandotte and Huron Plants and to efficiently utilize the capacity of the two plants.

The City of Detroit will continuously expand its treatment plant during the decade as new communities are added and population increases in the area tributary to the plant. The North Interceptor will be constructed from the pumping station now under construction at the Northeast Water Supply Plant to the Wastewater Treatment Plant on the River Rouge."

Wayne County 1990 Long Range Program Summary

"The City of Detroit, Wyandotte and Huron treatment plants will be expanded as needed to provide for the growing service areas in Macomb, Oakland, Wayne, Washtenaw and Monroe Counties."

WASHTENAW COUNTY[10]

Washtenaw County has four wastewater treatment and collection plans:

(1) Interim Water Quality Management Plan for the Southeast Michigan Metropolitan-Regional Area, WRC, March 1972.

(2) Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plans, SEMCOG, 1971.

(3) Pollution Control Program for the Detroit Regional Watershed, DMWD, 1966.

(4) Water Supply and Sanitary Sewerage Problems for Washtenaw County, 1966.

The statements of existing conditions and recent studies for Washtenaw County which follow are taken from SEMCOG.

"The County of Washtenaw retained two consultant engineering firms to prepare a joint report entitled Water Supply and Sanitary Sewerage Systems for Washtenaw County. This report was published in March 1966 and includes suggested improvements covering 5-year intervals through 1985. The following statement is taken from the report: "Communities on the Huron River from Ann Arbor downstream (Ypsilanti City and Ypsilanti Township) should continue to improve their highly efficient treatment of municipal and industrial wastes through continued use and improvement of the three principal waste disposal facilities now in use. No major benefit can be foreseen within the design period in consolidating these points of disposal or in removing the discharge from the Huron River only to reinject it at another location downstream."

These plans were amended in 1968 and 1969 with the recommendations that Ypsilanti Township and portions of Superior, Pittsfield and Augusta Townships adjacent to Ypsilanti Township be included in the service area of the proposed Huron River Interceptor. Ann Arbor and Ypsilanti would remain independent, with each retaining their own treatment plants on the Huron River. This approach has now been rejected by the State Water Resources Commission, in favor of a regional interceptor system along the Huron River."

Washtenaw County 1980 Short Range Programs Summary

"Present treatment plants on the Huron River serving the urbanized eastern part of the county will no longer be in operation. A massive interceptor, extending from the Huron River treatment plant northwesterly into Washenaw County, is expected to transmit the effluent of the service areas in the eastern part of the County, which includes Ann Arbor and Ypsilanti. The isolated areas of the county, will continue to be served by their own facilities."

Washtenaw County 1990 Long Range Program Summary

"The eastern part of Washtenaw County will continue to be serviced by the Huron River interceptor. The only difference from the 1980 configuration will be that the service area will be extended to accommodate the spread of urbanization around Ann Arbor and Ypsilanti cities and the township of Ypsilanti. This means that service will be extended into a good deal of Ann Arbor township and a part of Scio Township, as well as Pittsfield and Superior Townships. Saline, Dexter and the other small scattered cities will remain outside this area of service and therefore will continue operation of their own facilities."

MONROE COUNTY[16]

There are four Wastewater Treatment and Collection Plans for Monroe County:

(1) Interim Water Quality Management Plan for the Southeast Michigan Metropolitan-Regional Area, WRC, March 1972.

(2) Southeast Michigan Regional Water, Sewerage and Storm Drainage Facilities and Plan, SEMCOG,1971.

(3) Pollution Control Program for The Detroit Regional Watershed, DMWD, 1966.

(4) Clean Water - Official Plan of Action for Pollution Control and Sewer Collection and Water Supply, Transmission and Distribution Facilities, Monroe County, 1969.

The following statements of existing conditions and recent studies for Monroe County are taken from SEMCOG.

"Monroe County prepared a report dated August 1969 entitled Clean Water - Official Plan of Action for Pollution Control and Sewer Collection and Water Supply, Transmission and Distribution Facilities. The report became a part of the county's Complan 2000, the official planning guideline for the county until the year 2000. A Work Program timetable is included in the report. The report recommends the division of the county into three ultimate sewage disposal areas. One area will be serviced by the proposed Huron River interceptor, the River Raisin Basin will be served by the City of Monroe Metro treatment plant and the southern part of the county will be serviced by the Maumee River Basin Metro plants, city of Toledo. In the meantime several small interim plants have been and will be constructed."

Monore County 1980 Short Range Program Summary.

"During the 1970-1980 period the main interceptor in the Village of South Rockwood will be extended along the Huron River Drive to serve areas adjacent to the Huron River in what is now Berlin Township. The Township of Berlin has been ordered by the State Water Resources Commission to abate the pollution of Swan Creek. The area in the township along the creek is urbanizing and by 1972 sanitary sewers will be constructed through this area of the township. The Village of Estral Beach has also been cited by the Water Resources Commission for polltuion of Lake Erie. It is to be served by the Berlin Sewers and Plant.

An activated sludge treatment plant will be constructed by the county drain commission, acting as agent for the county, on Swan Creek approximately one and one-half miles upstream from the mouth of the creek. It is designed for 0.80 MGD to serve a population in the year 1980. The plant will serve both the Township and the Village of Estral Beach.

In 1969 the interceptor on Will-Carleton Drive in Ash Township was extended east to the

Pennsylvania Railroad.

Frenchtown Township will build a system of sewers along the lake-shore area south from the urbanized Stony Point area of the township. The interceptor here will connect to the Monroe Metro plant.

There is also another interceptor being built to serve Monroe Township, as well as the East part of Raisinville township. The interceptor will connect to the City of Monroe Metro Plant System and the wastewater will be treated at the newly expanded treatment plant in Monore. Those sewers will be built early in the 1970's by the Monore County Drain Commission.

The Village of Maybee has installed a system of sanitary sewers and three wastewater treatment lagoons. The lagoons are designed to serve a population of 1500 persons and the treated waste will be discharged into the Roberts Drain.

During the 1970-1980 decade additional interceptors will be extended westerly and northwesterly in the southwest corner of Bedford Township and across the township line into Whiteford Township.

The treatment plants in Luna Pier, Carleton and Petersburg will continue to serve their respective communities. The treatment plant in Dundee will be expanded and upgraded by 1972 to a capacity of .4 MGD.

The treatment plant in Milan is studying future expansion."

Monroe County 1990 Long Range Program Summary.

"Sometime before the year 1990 the Village of Carleton and the Ash Township sewer system will be connected to the proposed Huron River Interceptor by way of an interceptor along Carleton-South Rockwood Road to South Rockwood and thence across the river to the interceptor in Wayne County. The Lagoon treatment system will then be abandoned.

Before 1990 an interceptor will be completed along Blue Bush Road from the City of Monroe to the Village of Maybee. This construction will permit the abandonment of the wastewater treatment lagoons in the village and connection of the sewer system to the interceptor.

The treatment plants in Petersburg, Luna Pier and Bedford Township will continue to operate. After 1980 the Bedford Township will be expanded to a treatment capacity of 6.0 MGD.

Interceptor sewers will be constructed in Whiteford, Ida and Erie Townships which will connect to the Bedford treatment plant through the Bedford Township.

Interceptor sewers will be constructed in Erie Township and La Salle Township which will be connected to the expanded Luna Pier Treatment Plant.

Before the year 2000 the Berlin Township plant will be closed and the Berlin Township sewer system will be connected to the Huron River Metro regional plant at the mouth of the river. All of Frenchtown, Monroe and Raisinville Townships will be sewered, and interceptors will connect the systems to the City of Monroe Metropolitan plant."

Livingston County

Livingston County became part of SEMCOG in January 1972. Since it is a new member of the organization little information is available about current plans. Current contacts with the planning coordinator are underway to obtain more information about the area.

Lenawee County

Since Lenawee County is not part of the SEMCOG, DMWD or WRC Wastewater Regional Plans, less information is available.

The Lenawee County planning commission has issued two plans.

(1)Community Facilities Plan which includes the Water and Sewer Plan, the Recreation Plan, the County Buildings Plan, the Housing Study and Transportation Plan was completed by Parkins, Roger & Associates, Inc., in March 1970.

The Water and Sewer Plan divided Lenawee County into primary and secondary service areas for sewer and water utilities. The Adrian-Tecumseh-Clinton corridor, Addision-Hudson-Morenci, and Deerfield-Blissfield are the three primary service areas, while Fairfield-Jasper-Weston, Britton-Ridgeway and Onsted-Sand Lake-Wamplers Lake are the secondary service areas. All current major population centers as well as those areas planned for growth are included in these service areas. Existing sewage treatment systems are also evaluated.

Projected sewage flows and water needs are made for those communities having public utility systems. The Plan also related the capacity and quality of existing systems to the anticipated needs of that particular community. Appropriate recommendations are made on the basis of this anaylsis.

(2) Background for Planning, was completed by Parkins, Rogers & Associates, Inc., in June 1969. This report stated the following Plan:

Sanitary Sewer System.[1] - Lenawee County currently has no central sewerage system. It is recommended that the County establish a sanitary system to serve areas not able to be served by existing utility systems. The County is currently studying the matter of a central sewerage system.

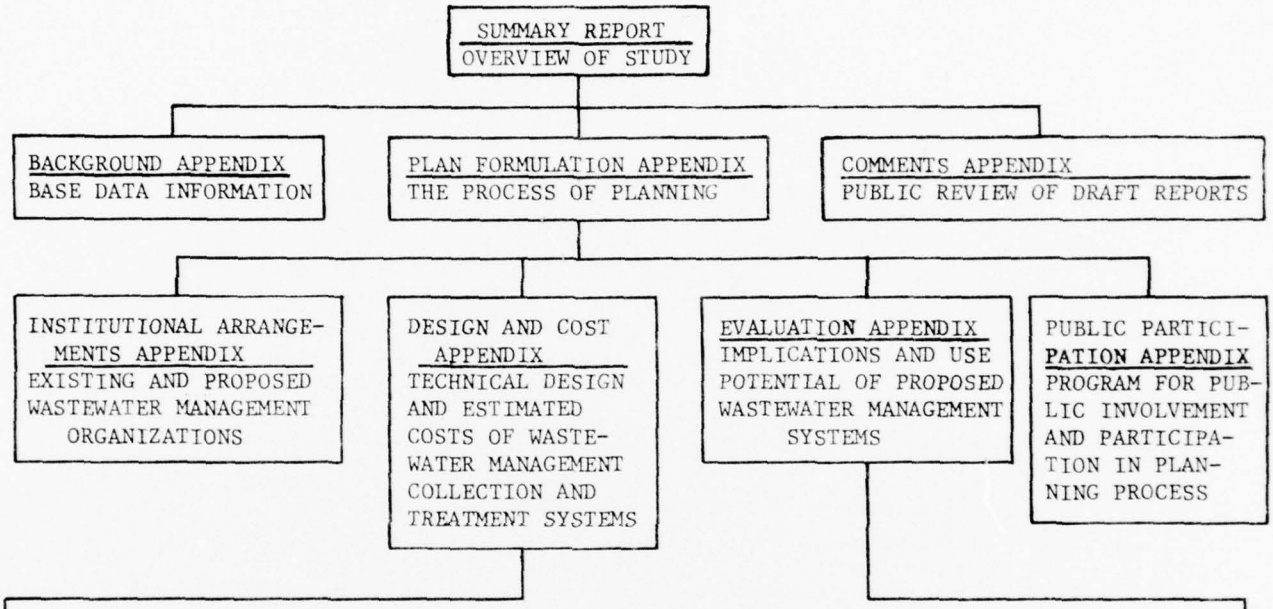
Studies so far have indicated that County sanitary sewer and treatment plant facilities planning and development will be comprised of two major systems embracing and conforming generally to the two principal watershed basin areas (Bean Creek and Raisin Valley). Planning for the development and implementation of these systems has been advanced in two time projections--the first increment being a 30-year projection forward from the present to Year 2000, and the second being a 50-year projection beyond Year 2000 to the Year 2050. Increment One encompasses project area development of new facilities in existing population centers and designated growth projection areas that have no existing population centers, and the expansion and extension of existing facilities in the primary urban centers. Increment Two then envisions consolidation of the urban centers and proposed project area sybsystems, as developed during increment One, into the two major basin systems.

Major System "A" along the west side of the County from north to south will be designated as The Bean Creek Collector System. It will include Cement City to the north, the Rollin-Woodstock-Devil's Lake-Addison area project, and the existing urban centers of Hudson and Morenci.

Major System "B" embracing all of the balance of the County area will be known as The Raisin Valley System. It will be comprised of three major arms: (1) The Clinton-Tecumseh-Raisin Arm; (2) The Onsted-Kingsley-Irish Lakes Arm; and (3) The Dover-Maddison-Adrian Arm, which conceivably might also include an extension north from the vicinity of the Village of Cadmus into Rome Township. It is also further foreseen that this system could involve extension to the southeast along the main valley to Palmyra, Blissfield, and Deerfield, and also include the Fairfield Township area to the south. In addition, one separate subsystem will be involved within the major Raisin Valley system in the County. This will be the Britton-Ridgeway project which lies in one of the two tributary areas of the main valley which fall to the east into Monroe County before joining the main body of the River Raisin. This project will be treated as a separate unit during increment period One, and could conceivably be joined with communities to the east in Monroe County during later consolidation.

SOUTHEASTERN MICHIGAN
WASTEWATER MANAGEMENT
SURVEY SCOPE STUDY

REPORT COMPOSITION



LAND IRRIGATION AND COLLECTION FACILITIES (DOW ENGINEERING INC.)

LAGOON TREATMENT AND CONVEYANCE SYSTEMS (BAUER ENGINEERING, INC.)

ALTERNATIVES FOR STORMWATER RUNOFF CONTROL (AYRES, LEWIS, NORRIS AND MAY, INC.)

ADVANCED WASTEWATER TREATMENT FACILITIES (STANLEY CONSULTANTS)

INDEPENDENT PHYSICAL-CHEMICAL TREATMENT FACILITIES (IN CONSULTATION WITH WALTER J. WEBER Jr. Ph.D.)

GEOLOGIC CONSIDERATIONS (ANDREW J. MOZOLA, Ph.D.)

LAND TREATMENT OF WASTEWATER IN SOUTHEASTERN MICHIGAN (DEPT. OF CROP & SOIL SCIENCES, MSU)

WASTEWATER IRRIGATION USING PRIVATELY OWNED FARMLAND IN SOUTHEASTERN MICHIGAN (DOW ENGINEERING, INC.)

ECOLOGICAL ASSESSMENT FOR WASTEWATER MANAGEMENT SEM (INSTITUTE OF WATER RESEARCH, MSU)

HYGIENIC ASSESSMENTS (SCHOOL OF PUBLIC HEALTH, U OF M)

ECONOMIC (AREA) ASSESSMENT AND SOCIAL ASSESSMENT (MR. PAUL M. REID)

AGRICULTURAL ECONOMIC ASSESSMENT AND AN ANALYSIS OF ZONES PROPOSED FOR LAND TREATMENT OF WASTEWATER (MR. LEE A. CHRISTENSEN, ECONOMIC RESEARCH SERVICE, USDA.)

AESTHETIC ASSESSMENT (DETROIT DISTRICT STAFF)

FOOTNOTES

1. Environmental Assessment Phase I Plans for Water Quality Management Southeastern Michigan Area, WRC, Feb 1972

2. Southeastern Michigan Water Resources Study
   Gazetter of Black River Basin
   Technical Paper #3
   Corps of Engineers, Detroit, March 1969

3. Southeastern Michigan Water Resources Study
   Gazetter of Pine River Basin
   Technical Paper #4
   Corps of Engineers, Detroit, June 1969

4. Southeastern Michigan Water Resources Study
   Gazetter of Belle River Basin
   Technical Paper #2
   Corps of Engineers, Detroit, June 1969

5. Southeastern Michigan Water Resources Study
   Gazetter of Clinton River Basin
   Technical Paper #5
   Corps of Engineers, Detroit, June 1971

6. Southeastern Michigan Water Resources Study
   Gazetter of Raisin River Basin
   Technical Paper #6
   Corps of Engineers, Detroit, March 1972

7. Southeastern Michigan Water Resources Study
   Gazetter of River Rouge Basin
   Technical Paper No. 1
   Corps of Engineers, Detroit, March 1969

8. Southeastern Michigan Water Resources Study
   Mineral Resources Appendix, 1st Draft
   Corps of Engineers, Detroit, April 1970

9. The Water Resources of Southeastern Michigan
   State of Michigan, Water Resources Commission
   Department of Conservation, February 1968

10. Ecological Assessment for Southeastern Michigan
    Wastewater Management Study
    IWR

11. Goals for the 1990 Regional Development Plan,
    Southeast Michigan Council of Governments,
    adopted Jan. 1972.

FOOTNOTES (continued)

12. Appendix 3, Geology and Groundwater, Draft #2, GLBC, March 1971

13. Appendix 2, Surface Water Hydrology, GLBC, 1971.

14. Appendix #6, Water Supply-Municipal, Industrial, and Rural, Draft #2, GLBC, Oct 1971.

15. Appendix No. 7, Water Quality and Pollution Control, Draft No. 1, GLBC, November 1971

16. Southeastern Michigan Regional Water Sewerage and Drainage Facilities Plan, SEMCOG 1971

17. Interview with Lenawee County Drain Commissioner, April 1969.

INCLOSURE 1

List of Municipal and Industrial Wastewater Discharges

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA No. 1	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITIES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
BELLE RIVER DISTRICT													
ALGONAC	ST. CLAIR R.		5,200										
ST. CLAIR	ST. CLAIR R.	PRIMARY	5,000			0.8							
MARINE CITY	ST. CLAIR R.	PRIMARY	3,400			0.6							
*BERLIN TWP.													
*RILEY TWP.													
*WALES TWP.													
*KIMBALL TWP.													
*COLUMBUS TWP.													
*ST. CLAIR TWP.													
*CASCO TWP.													
*CHINA TWP.													
E. CHINA TWP.	ST. CLAIR R.	PRIMARY	250			0.15							
*COTTRELVILLE TWP.													
CLAY TWP.	ANCHOR BAY		1,500										
*IRA TWP.													
PORT HURON MILL CREEK DISTRICT													
PORT HURON	ST. CLAIR R.	PRIMARY	36,300			12.5							
*YALE													
*LYNN TWP.													
*BROCKWAY TWP.													
*GREENWOOD TWP.													
*MUSSEY TWP.													
*EMMET TWP.													
*KENOCKEE TWP.													
*GRANT TWP.													
*BURTCHVILLE TWP.													
*FT. GRATIOT TWP.													
*PORT HURON TWP.													
*CLYDE TWP.													
MARYSVILLE	ST. CLAIR R.	PRIMARY	4,900			1.2							

SOURCE: STATE OF MICHIGAN WATER RESOURCE COMMISSION - APRIL 1967

*NO SATISFACTORY INFORMATION AVAILABLE OR REFERENCE "POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED 1966 - DETROIT METRO WATER SERVICES DEPT."

NOTE: SEPTIC TANKS STILL SERVE A SIGNIFICANT PORTION OF THE SUBAREA NOT SERVED BY PRESENT MUNICIPAL SEWERS

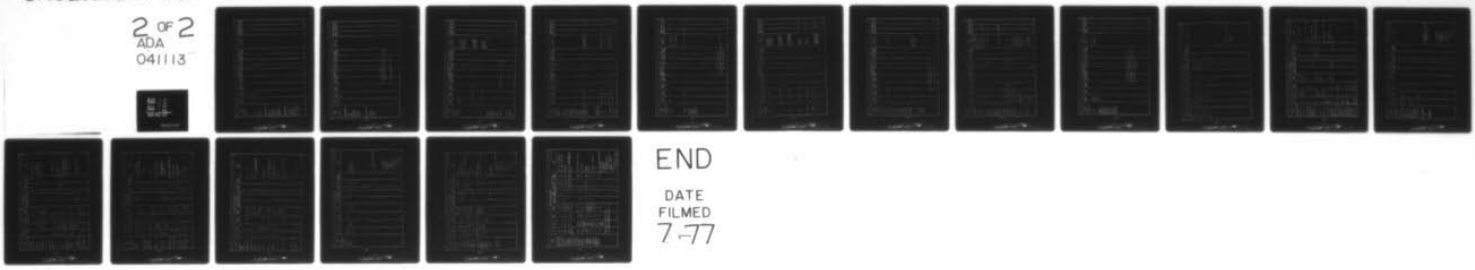
MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 2	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
PONTIAC DISTRICT - 2 PLANTS	CLINTON RIVER	ACTIVATED SLUDGE				22.37							
NORTHEAST OAKLAND COUNTY DISTRICT													
CLARKSTON	CLINTON RIVER	SEPTIC TANK											
WATERFORD TWP., 2 PLANTS	CLINTON RIVER	SAND FILTERS											
*OXFORD													
*LEONARD													
*ADDISON TWP.													
*OAKLAND TWP.													
*ORION TWP.													
*AVON TWP.													
*PONTIAC TWP.													
*INDEPENDENCE TWP.													
NORTH MACOMB COUNTY DISTRICT													
NEW BALTIMORE	MINORITY TRIB. BASIN (LAKE ST. CLAIR)	TRICKLING FILTER	3,700 (EST. 1964)										
ARMADA	CLINTON RIVER	TRICKLING FILTER				0.191							
ROMEO	CLINTON RIVER	TRICKLING FILTER											
*BRUCE TWP.													
*ARMADA TWP.													
RICHMOND	MINOR TRIB. BASIN	TRICKLING FILTER											
*RICHMOND TWP.													
*WASHINGTON TWP.													
*RAY TWP.													
*LENOX TWP.													
*MACOMB TWP.													
*CHESTERFIELD TWP.													
NEW HAVEN	MINOR TRIB. BASIN	TRICKLING FILTER											

AD-A041 113 CORPS OF ENGINEERS DETROIT MICH DETROIT DISTRICT F/G 13/2
SOUTHEASTERN MICHIGAN WASTEWATER MANAGEMENT SURVEY SCOPE STUDY.--ETC(U)
MAY 74

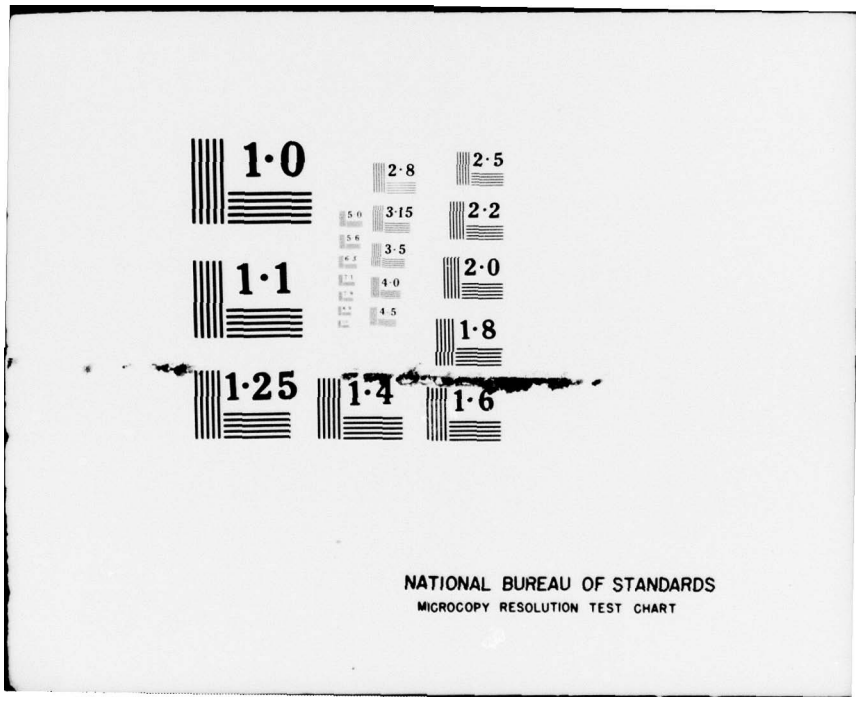
UNCLASSIFIED NL

2 OF 2
ADA
041113



END

DATE
FILMED
7-77


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
2·8
3·15
3·5
4·0
4·5
5·0
5·6
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA No. 2	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
OAKLAND MACOMB INTERCEPTOR DISTRICT													
ROCHESTER - 2 PLANTS	CLINTON RIVER	ACTIVATED SLUDGE				-----							
STERLING TWP.	CLINTON RIVER	ACTIVATED SLUDGE				3.03							
UTICA	CLINTON RIVER	ACTIVATED SLUDGE				3.34							
MT. CLEMENS - 2 PLANTS	CLINTON RIVER	TRICKLING FILTER				4.37							
CLINTON TWP.	CLINTON RIVER	TRICKLING FILTER				4.79							
*SHELBY TWP.													
*HARRISON TWP.													
*FRASER													
EVERGREEN-FARMINGTON INTERCEPTOR DISTRICT													
*BEVERLY HILLS													
*BIRMINGHAM													
*BLOOMFIELD HILLS													
*BLOOMFIELD TWP.													
*FARMINGTON TWP.													
*KEEGO HARBOR													
*LATHRUP VILLAGE													
*SOUTHFIELD													
*WEST BLOOMFIELD TWP.													
*FARMINGTON CITY													
*PONTIAC TWP.													
WAYNE COUNTY NORTHEAST INTERCEPTOR DISTRICT													
*EAST DETROIT													
*ST. CLAIR SHORES													
*ROSEVILLE													
*HARPER WOODS													
*GROSSE PTE. WOODS													
*GROSSE PTE. SHORES													
*GROSSE PTE. FARMS													
*CITY OF GROSSE PTE.													
*GROSSE PTE. PARK													

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 2	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
WARREN DISTRICT	CLINTON RIVER	ACTIVATED SLUDGE				24.3							
SOUTHEAST OAKLAND COUNTY SEWAGE DISPOSAL DISTRICT													
*BERKLEY													
*CLAWSON													
*FERNDALE													
*HAZEL PARK													
*HUNTINGTON WOODS													
*MADISON HEIGHTS													
*OAK PARK													
*PLEASANT RIDGE													
*ROYAL OAK													
*ROYAL OAK TWP.													
*TROY													
DETROIT RIVER INTERCEPTOR SYSTEM DISTRICT													
*DETROIT													
*HIGHLAND PARK													
*HAMTRAMCK													
*CENTERLINE													
*DEARBORN													

SOURCE: STATE OF MICHIGAN WATER RESOURCES OF SE MICHIGAN - FEBRUARY 1968
MICHIGAN WATER RESOURCES COMMISSION - MAY 1970

*NO SATISFACTORY INFORMATION AVAILABLE OR REFERENCE: "POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED 1964 - DETROIT METRO WATER SERVICES DEPT."

NOTE: SEPTIC TANKS STILL SERVE A SIGNIFICANT PORTION OF THE SUBAREA NOT SERVED BY PRESENT MUNICIPAL SEWERS

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 3	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
SOUTH WEST OAKLAND COUNTY DISTRICT													
HURON CLINTON METROPOLITAN AUTHORITY	KENT LAKE (HURON R.)	SAND FILTER	5,000	--- NO DATA AVAILABLE ---				X		EFFLUENT DISCHARGES TO SURFACE WATERS WILL BE ELIMINATED PRIOR TO JUNE 1, 1970 GROUND WATER WILL BE MONITORED AND PHOSPHOROUS REMOVAL PROVIDED IF NECESSARY.			
MILFORD	HURON R.	ACTIVATED SLUDGE	4,900	17	29	0.61		X		FINAL ORDER NOVEMBER 1, 1960. THE COMMISSION HAS ASKED FOR PHOSPHOROUS REMOVAL BY JUNE 1, 1970.			
SOUTH LYON	HURON R.	ACTIVATED SLUDGE	1,755	5	11	0.32				A VOLUNTARY REDUCTION OF PHOSPHORUS COMPOUNDS IN THE DISCHARGE IS BEING SOUGHT BY JUNE 1, 1970.			
*WALLED LAKE													
*WIXOM													
*HIGHLAND TWP.													
*WHITELAKE TWP.													
*COMMERCE TWP.													
*MILFORD TWP.													
*LYON TWP.													
*NOVI TWP.													
*SPRINGFIELD TWP.													
ROUGE VALLEY SEWAGE DISPOSAL SYSTEM - DISTRICT			NO MUNICIPAL WASTE TREATMENT PLANT DISCHARGE IN THE RIVER ROUGE BASIN										
*LIVONIA													
*REDFORD TWP.													
*GARDEN CITY													
*DEARBORN HEIGHTS													
*INKSTER													
*WAYNE													

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 5	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
ROUGE VALLEY SEWAGE DISPOSAL SYSTEM-DISTRICT (CONTINUED)	NO MUNICIPAL WASTE TREATMENT PLANT DISCHARGE IN THE RIVER ROUGE BASIN												
*PLYMOUTH													
*NORTHVILLE													
*NORTHVILLE TWP.													
*PLYMOUTH TWP.													
*CANTON TWP.													
DOWN RIVER SEWAGE DISPOAL SYSTEM-DISTRICT													
*VAN BUREN TWP.													
*ROMULUS TWP.													
*BELLEVILLE													
*ECORSE													
*LINCOLN PARK													
*RIVER ROUGE													
*SOUTHGATE													
*WYANDOTTE WAYNE COUNTY	DETROIT RIVER	PRIMARY	44,000	85	60	47.09		X	X	A REVISED STIPULATION HAS BEEN DEVELOPED PROVIDING FOR SECONDARY TREATMENT BY OCT. 1, 1972			
*ALLEN PARK													
*TAYLOR TWP.											11/1/71	---	10/1/72
RIVERVIEW- TRENTON-GIBRALTAR- GROSSE ILE-DISTRICT													
RIVERVIEW*	DETROIT RIVER	PRIMARY	8,000	150	73	1.68		X	X	STIPULATION SIGNED APRIL 5, 1966. PLAN NOT ACCEPTED	11/1/68	---	11/1/70
TRENTON	DETROIT RIVER	PRIMARY	22,000	95	92	3.09		X	X	STIPULATION SIGNED JUNE 7, 1966.	11/1/69	---	11/1/70
WAYNE COUNTY-TRENTON	DETROIT RIVER	PRIMARY		61	44	1.5		X	X	WAYNE COUNTY STIPULATION SIGNED MAY 27, 1966.	11/1/68	---	11/1/70
GROSSE ILE TWP.	DETROIT RIVER	PRIMARY	6,318	53	40	1.28		X	X	STIPULATION SIGNED MARCH 29, 1966.			
*GIBRALTAR											11/1/68	---	11/1/70

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 3	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
LOWER HURON RIVER DISTRICT													
FLAT ROCK WAYNE COUNTY	HURON RIVER	PRIMARY	5,100	129	62	0.44		X	X	FINAL ORDER ADOPTED MAY 26, 1967. CONSTRUCTION PROCEEDED UNDER COURT ORDER ISSUED SEPT. 10, 1968. SECONDARY TREATMENT FACILITIES IN OPERATION MAY 13, 1970.	10/1/68	11/30/68	12/31/69
ROCKWOOD WAYNE COUNTY	HURON RIVER	PRIMARY	2,026	130		0.19		X	X	FINAL ORDER ADOPTED JAN. 15, 1969	5/1/69	10/1/69	10/1/70
*S. ROCKWOOD *WOODHAVEN *SUMPTER TWP. *HURON TWP. *BROWNSTOWN TWP. *FLAT ROCK TWP. *BERLIN TWP.													

SOURCE: MICHIGAN WATER RESOURCE COMMISSION - MAY 1970.

*NO SATISFACTORY INFORMATION AVAILABLE OR REFERENCE "POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED 1966 - DETROIT METRO WATER SERVICES DEPT."

NOTE: SEPTIC TANKS STILL SERVE A SIGNIFICANT PORTION OF THE SUBAREA NOT SERVED BY PRESENT MUNICIPAL SEWERS.

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 4	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
UPPER HURON R. DISTRICT													
ANN ARBOR	HURON R.	ACTIVATED SLUDGE	74,000	44	100	14.2		X	X	CITY HAS AGREED TO PROVIDE PHOSPHATE REMOVAL BY JUNE 1, 1970, HOWEVER LACK OF FUNDING WILL PROBABLY PREVENT COMPLETION BY AGREED UPON DATE.			
SALINE	SALINE R.	TRICKING FILTER	2,334	34	29	1.07		X		FINAL ORDER ADOPTED SEPT. 25, 1951. PLANS TO ENLARGE AND IMPROVE TREATMENT FACILITIES HAVE BEEN IMPROVED.			
CHELSEA	MILLCREEK	ACTIVATED SLUDGE	3,600	14	11	0.34		X		A VOLUNTARY REDUCTION OF PHOSPHOROUS COMPOUNDS IN THE DISCHARGE IS BEING SOUGHT BY WATER RESOURCES COMMISSION.			
DEXTER	HURON R.	PRIMARY	1,702	213	171	0.13		X	X	FINAL ORDER OF DETERMINATION ADOPTED ON OCT. 20, 1969.	9/1/70	3/1/71	3/1/72
NORTHFIELD TWP.	HURON R.	TRICKING FILTER	3,279	14	30	0.17		X	X	FINAL ORDER OF DETERMINATION ADOPTED ON OCT. 20, 1969.	6/1/70	10/1/70	1/1/72
SCIO-WEBESTER AUTHORITY	HURON R.	TRICKING FILTER			30	0.055							
YPSILANTI TWP.	HURON R.	ACTIVATED SLUDGE	22,800	39	62	7.5		X		PORTIONS OF EXCESS FLOW ARE NOW DIVERTED TO WAYNE CO. SYSTEM. PHOSPHOROUS REMOVAL IN OPERATION 25 MAY 1970.		10/1/68	6/1/70

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 4	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITIES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
UPPER HURON R. DISTRICT													
*SUPERIOR TWP.													
*SALINE TWP.													
*AUGUSTA TWP.													
*YORK TWP.													
*BRIDGEWATER TWP.													
MANCHESTER	RAISIN R.	TRICKLING FILTER	1,568	10	20	0.25				FINAL ORDER ADOPTED JUNE 27, 1951			
*MANCHESTER TWP.													
*PITTSFIELD TWP.													
*LODI TWP.													
*FREEDOM TWP.													
*SCIO TWP.													
*SHARON TWP.													
*SYLVAN TWP.													
*LIMA TWP.													
*SCIPIO TWP.													
*ANN ARBOR TWP.													
*SALEM TWP.													
*WEBESTER TWP.													
*DEXTER TWP.													
*LYDON TWP.													
*YPSILANTI													
LOWER LIVINGSTON COUNTY DISTRICT													
BRIGHTON	HURON R.	TRICKLING FILTER	2,282	24	18	0.63				CITY HAS AGREED TO ACCELERATE ITS PROGRAM OF PHOSPHATE REMOVAL. COMPLETION DATE, JUNE 1, 1970.			
*PINCKNEY TWP.													
*PUTNAM TWP.													
*UNADILLA TWP.													
*HAMBURG TWP.													
*GREEN OAK TWP.													
*BRIGHTON TWP.													

SOURCE: MICHIGAN WATER RESOURCES COMMISSION - MAY 1970

*NO SATISFACTORY INFORMATION AVAILABLE OR REFERENCE "POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED 1966 - DETROIT METRO WATER SERVICES DEPT."

NOTE: SEPTIC TANKS STILL SERVE A SIGNIFICANT PORTION OF THE SUBAREA NOT SERVED BY PRESENT MUNICIPAL SEWERS.

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA No.	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
RAISIN RIVER DISTRICT													
*MONROE	RAISIN R.	PRIMARY	25,600	64	64	4.45	(MGD)	X	X	STIPULATION SIGNED MAY 29, 1966. FINAL ORDER ADOPTED OCT. 20, 1969. FACILITIES UNDER CONSTRUCTION.	11/30/69	4/1/70	6/1/70
*EARLETON	SNAN CREEK	LAGOONS	1,379	11	46	50*			X	EXPANDED LAGOON SYSTEM - COMPLETION SCHEDULED DECEMBER 31, 1970.			
***BERLIN TWP.													
***SOUTH MONROE													
*MONROE TWP.	RAISIN R.	NONE						X	X	STIPULATION DATED 3/5/66; AMENDED 8/13/68	AS 11/30/68	AMENDED 7/1/69	12/1/70
*DUNDEE	RAISIN R.	PRIMARY	2,377	64	46	0.13	0.45MGD	X		FINAL ORDER ADOPTED SEPTEMBER 25, 1951			
***DUNDEE TWP.													
***LONDON TWP.													
*MILAN	SALINE R.	TRICKLING FIL.	3,616	19	14	0.81	0.45MGD	X		FINAL ORDER ADOPTED SEPTEMBER 25, 1951	11/1/68	2/1/69	12/1/70
***MILAN TWP.													
***ASH TWP.													
***EXETER TWP.													
***RAISINVILLE TWP.													
***SUMMERFIELD TWP.													
***IDA TWP.													
***LA SALLE TWP.													
**FRENCHTOWN TWP.	RAISIN R.	NONE						X	X	STIPULATION DATED 3/5/66; AMENDED 8/13/68	AS 9/30/68	AMENDED 5/1/69	5/1/70
UPPER RAISIN R. DISTRICT													
*ADRIAN	RAISIN R.	ACTIVATED SLUDGE	19,800	6	13	2.34	5.0MGD	X					
***ADRIAN TWP.													
*BLISSFIELD	RAISIN R.,	PRIMARY	2,600	59	62	0.32	0.45MGD	X		FINAL ORDER ADOPTED SEPT. 25, 1951			
***BLISSFIELD TWP.													
*CLINTON	RAISIN R.	PRIMARY	1,481	138	132	0.07	0.2MGD						
***CLINTON TWP.													
*TECUMSECH	RAISIN R.	ACTIVATED SLUDGE	7,300	16	11	0.99	1.4MGD	X		ORDER OF DETERMINATION AUGUST 25, 1949			
***TECUMSECH TWP.													
**FAIRFIELD TWP.	BLACK CREEK	NONE							X	FINAL ORDER ADOPTED APRIL 25, 1968; SHOW CAUSE CONFERENCE JANUARY 16, 1969			
**RIDGEWAY TWP.	WILSON SPRINGBROOK DRAIN TO RAISIN R.	NONE							X	FINAL ORDER ADOPTED APRIL 25, 1968; SHOW CAUSE CONFERENCE JANUARY 16, 1969			
**DEERFIELD	RAISIN R.	NONE							X	FINAL ORDER ADOPTED APRIL 25, 1968	12/1/68	9/30/69	12/31/70
***DEERFIELD TWP.													
**BRITTON	S. MACOMB CREEK VIA UNNAMED CREEK	NONE							X	FINAL ORDER ADOPTED APRIL 25, 1968 SHOW CAUSE CONFERENCE JANUARY 16, 1969			

*YEARLY AVG.

MUNICIPAL WASTEWATER DISCHARGES

SUBAREA NO. 5	RECEIVING WATERS	TREATMENT PROVIDED	POPULATION SERVED-EST. -1964	DISCHARGE CHARACTERISTICS				IMPROVEMENT NEEDS		STATUS AND ABATEMENT ACTION	PROGRAM FOR REMEDIAL FACILITES		
				5 DAY BOD EFFLUENT MG/L	SUSPENDED SOLIDS EFFLUENT MG/L	FLOW MGD	PLANT DESIGN FLOW	NUTRIENT REDUCTION	NEW OR IMPROVED TREATMENT		PLANS APPROVED	START CONST.	COMPLETION
UPPER RAISIN R. DISTRICT													
**CLAYTON	S. BRANCH RAISIN R.	NONE							X	FINAL ORDER ADOPTED DECEMBER 11, 1968	2/1/69	9/1/69	9/1/70
**ONSTED	WOLF CREEK VIA ONSTED DRAIN	NONE							X	FINAL ORDER ADOPTED MARCH 26, 1968			
**CEMENT CITY	GOOSE CREEK	NONE											
***DOVER TWP.													
***FRANKLIN TWP.													
***MACON TWP.													
***MADISON TWP.													
***OGDEN TWP.													
***PALMYRIA TWP.													
***RAISIN TWP.													
***SENECA TWP.													
***ROME TWP.													
***RIGA TWP.													
***RIDGEWAY TWP.													
***CAMBRIDGE TWP.													
***WOODSTOCK TWP.													

* SOURCE: MICHIGAN WATER RESOURCES COMMISSION - MAY 1970

** SOURCE: MICHIGAN WATER RESOURCES COMMISSION AND MICHIGAN DEPARTMENT OF PUBLIC HEALTH - RELEASE - 1969

***NO SATISFACTORY INFORMATION AVAILABLE OR REFERENCE "POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED 1966 - DETROIT METRO WATER SERVICES DEPT."

NOTE: SEPTIC TANKS STILL SERVE A SIGNIFICANT PORTION OF THE SUBAREA NOT SERVED BY PRESENT MUNICIPAL SEWERS

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 1	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMINATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
PORT HURON - MILL CREEK DISTRICT										
DUNN PAPER	PORT HURON	PAPER	ST. CLAIR R.	SAVE-ALLS		SUSPENDED SOLIDS	N/A	A (1966)		
MORTON SALT CO.	MARYSVILLE	CHEMICAL	ST. CLAIR R.	NONE		CHLORIDES	N/A	A (1966)		
MARYSVILLE PLATING CO.	MARYSVILLE	METAL	ST. CLAIR R.	CHEMICAL		CHROMIUM CYANIDE	0.008	A (1966)		
DETROIT EDISION	MARYSVILLE	POWER GENERATION	ST. CLAIR R.	NO TREATMENT		USE-COOLING AND CONDENSER WATER	554.3			
BELLE RIVER DISTRICT										
DETROIT EDISION COMPANY	ST. CLAIR	POWER GENERATION	ST. CLAIR R.	NO TREATMENT		USE-COOLING AND CONDENSER WATER	319.6			
DIAMOND CRYSTAL SALT COMPANY	ST. CLAIR	CHEMICAL	ST. CLAIR R.	DEEP WELL DISPOSAL		SALT BRINE	N/A	A (1966)		

SOURCE:

STATE OF MICHIGAN WATER RESOURCES COMMISSION

APRIL 1967

KEY TO STATUS

A - CONTROL ADEQUATE

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 2	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
DETROIT RIVER INTERCEPTOR SYSTEM - DISTRICT										
ALLIED CHEMICAL CORP., SEMET SOLVEY DIVISION	DETROIT	FOUNDRY, COKE AND COKE PROD.	-----	DEEP WELL OPERA-TIONAL DIFFICULTIES		7,270	5.9	PHENOL-E OIL-E	4/5/66 7/26/68	FACILITIES PROVIDED, IMPROVED OPERATION REQUIRED.
ANACONDA AMERICAN BRASS CO.	DETROIT	COPPER AND BRASS PRODUCTS	-----	NEUTRALIZATION AND SETTLING			0.96	B		DISCHARGE TO DETROIT STORM SEWER
ALLIED CHEMICAL CORP., PLASTICS DIVISION	DETROIT	COAL TARS AND OILS	ROUGE RIVER	DEPHENOLIZER, SETTLING BASINS OIL SKIMMERS			0.48	Bs		
ALLIED CHEMICAL CORP., IND. CHEMICALS DIVN., DETROIT CHEMICAL WORKS	DETROIT	CHEMICALS	ROUGE RIVER	PONDS		4,990	9.11	D		CORRECTIONS UNDERWAY TO IMPROVE DEEP WELL DISPOSAL OF WASTE
AMERICAN CEMENT CORP., PEERLESS DIVN., JEFFERSON STREET PLANT	DETROIT	CEMENT	OLD CHANNEL ROUGE RIVER	SETTLING TANK		4,970	8.1	B	4/5/66	IN COMPLIANCE
AMERICAN CEMENT CORP., PEERLESS DIVN., BRENNAN STREET PLANT	DETROIT	CEMENT	ROUGE RIVER	NONE	NO DATA AVAILABLE			E_P	2/18/70	TREATMENT FACILITIES UNDER CONSTRUCTION
FORD MOTOR CO., ROUGE PLANT	DEARBORN	STEEL, CAST-INGS, GLASS AND AUTOMOTIVE ASSEMBLY	ROUGE RIVER	OIL SKIMMERS, DEEP WELL DISPOSAL AND CLARIFIER		311,700	362	ACID-B OIL-E_C CYANIDE-A SOLIDS-E_S PHENOLS-E_S	5/17/66 5/21/70	NEW OIL SEPARATION FACILITIES IN OPERATION. PROGRAM IN EFFECT TO PROVIDE ADDITIONAL TREATMENT.
REVERE COPPER AND BRASS, INC.	DETROIT	METAL PARTS	-----	OIL SEPARATORS INCINERATOR		1,088	2.9	D	5/13/66	NOW IN COMPLIANCE
U.S. RUBBER CO.	DETROIT	RUBBER AND CHEMICALS	-----	OIL SKIMMERS		12,480	42	A		
PARK DAVIS AND COMPANY	DETROIT	PHARMACEUTICALS	-----	NONE			8.1	A		PROCESS WASTES TO DETROIT S.T.P. COOLING WATER ONLY
DETROIT EDISON COMPANY	DETROIT (CONNERS CR)	ELECTRICITY	-----	ASH LAGOONS			299.5	B		PRIMARILY COOLING WATER
DETROIT EDISON COMPANY	DETROIT (DELRAY PLANT)	ELECTRICITY	-----	ASH LAGOONS			273.6	B		PRIMARILY COOLING WATER
GENERAL MOTORS CORP., DETROIT DIESEL ENGINE DIVN.	DETROIT	AUTOMOTIVE PARTS	ROUGE RIVER	OIL SEPARATORS AND SETTLING TANKS	NO DATA AVAILABLE			A		FURTHER TREATMENT FACILITIES PLANNED.
SCOTT PAPER CO.	DETROIT	PAPER	ROUGE RIVER	SCREENS, SAVE-ALLS	NO DATA AVAILABLE			A	11/4/66 4/24/68	IN COMPLIANCE
NORTHEAST OAKLAND COUNTY DISTRICT										
AUBURN HEIGHTS MANUFACTUR-ING	AUBURN HEIGHTS	METAL	CLINTON RIVER VIA DRAIN				N/A			
SUPERIOR PRODUCTS COMPANY	AUBURN HEIGHTS	METAL STAMPING	CLINTON RIVER				N/A			
OAKLAND-MACOMB INTERCEPTOR DISTRICT										
AVON INDUSTRIES	ROCHESTER	-----	PAINT CREEK				.036			
NATIONAL TWIST DRILL AND TOOL COMPANY	STONY CREEK	METAL					0.2			
ROCHESTER PAPER COMPANY		PAPER	CLINTON RIVER				0.29			
FORD MOTOR COMPANY TRANSMISSION & CHASSIS DIVN.	STERLING TWP., MACOMB COUNTY	AUTOMOTIVE	CLINTON RIVER				.993			
FORD MOTOR COMPANY, AUTOMO-TIVE ASSEMBLY DIVN.	UTICA	FABRIC	CLINTON RIVER				.212			
NATIONAL MACHINE PRODUCTS COMPANY	UTICA	METAL	CLINTON RIVER				0.58			
LTV AEROSPACE CORP., MISS MISSILES & SPACE DIVN.	STERLING TWP., MACOMB COUNTY	METAL	CLINTON RIVER VIA MOORE DRAIN				1.013			
BRIGGS MANUFACTURING CO.	STERLING TWP., MACOMB COUNTY	METAL	BEAVER CREEK				.001			

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 2	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
OAKLAND-MACOMB INTERCEPTOR DISTRICT (CONT'D)										
TRW INCORPORATED, MICHIGAN DIVISION	STERLING TWP., MACOMB COUNTY	METAL	BEAVER CREEK				.125			
FORD MOTOR CO., GLASS & CHEMICAL DIVN., PAINT PLANT	MT. CLEMENS	AUTOMOTIVE	GREINER DRAIN				.001			
FORD MOTOR CO., GLASS & CHEMICAL DIVN., PLASTICS PLANT	MT. CLEMENS	AUTOMOTIVE	GREINER DRAIN				.068			
NORTH MACOMB COUNTY DISTRICT										
FORD MOTOR CO., PROVING GROUNDS	BRUCE TWP., MACOMB COUNTY	METAL	FISHER CREEK				.007			
WARREN-MACOMB COUNTY DISTRICT										
ROBIN PRODUCT COMPANY	WARREN	METAL	FOGG DRAIN				N/A			
SOUTHEAST OAKLAND COUNTY DISPOSAL SYSTEM DISTRICT										
MSU - OAKLAND COUNTY	CLINTON RIVER	TRICKLING FILTER								
EVERGREEN-FARMINGTON INTERCEPTOR DISTRICT										
NONE										SOURCE: STATE OF MICHIGAN WATER RESOURCES OF SOUTHEASTERN MICHIGAN FEBRUARY 1968 MICHIGAN WATER RESOURCES COMMISSION MAY 1970
WAYNE COUNTY NE INTERCEPTOR DISTRICT										
NONE										

KEY TO CONTROL STATUS

A - CONTROL ADEQUATE

B - CONTROL PROVIDED - ADEQUACY NOT FULLY ESTABLISHED.

C - NO CONTROL - NEED NOT ESTABLISHED.

D - CONTROL PROVIDED - PROTECTION UNRELIABLE.

E - CONTROL INADEQUATE

c - CONSTRUCTION UNDERWAY

p - PLANS BEING PREPARED

s - STUDIES UNDERWAY

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 3	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
SOUTHWEST OAKLAND COUNTY DISTRICT										
FORD MOTOR COMPANY AUTO ASSEMBLY DIVN.	WIXOM	AUTO ASSEMBLY	NORTON DRAIN	CHEMICAL TREATMENT SETTLING POND, TRICKLING FILTER	795.89	229.13	1.411	IND-E_C SAN-E	10/31/63	AERATION LAGOON TO BE COMPLETED BY JUNE 1, 1970
MICHIGAN SEAMLESS TUBE COMPANY	SOUTH LYON	METAL TUBING	HURON RIVER VIA DRAIN	SETTLING TANKS	162.0	965.0	1.2	B	6/13/68	ADDITIONAL TREATMENT FACILITIES CONSTRUCTED AND OPERATING
GUARDIAN INDUSTRIES	NOVI	PHOTO PROCESSING	MIDDLE ROUGE RIVER	AERATION AND LAGOONS			0.04	B	4/24/68	TREATMENT FACILITIES COMPLETED
ENAMELUM CORP. AND INTERLAKE WINDOWS	NOVI	ALUMINUM PRODUCTS	WALL LAKE CREEK	LAGOONS AND CHEMICAL TREATMENT	0.0	14	0.08	E_P		TREATMENT FACILITIES PLANNED
GENERAL VILTERS	NOVI	FILTERS	MIDDLE ROUGE RIVER	SMALL EARTHEN SETTLING POND	48 (mg/l)	137 (mg/l)	5 (gpm)	B		
ROUGE VALLEY SEWAGE DISPOSAL SYSTEM DISTRICT										
ASSOCIATED SPRINGS CORP., BGP DIVN.	PLYMOUTH	SPRINGS	MIDDLE ROUGE RIVER	NONE	60	150	0.174	C		MAJOR PROCESS WASTES ARE DISCHARGED TO MUNICIPAL SYSTEM
BURROUGHS CORP.	PLYMOUTH	BUSINESS MACHINES	MIDDLE ROUGE RIVER	OIL SUMP	81.1	543	0.304	A		
CAM CHEM. CO.	WAYNE	PETROLEUM PRODUCTS	TROUTON DRAIN	PONDS	--------NO DATA AVAILABLE----		----	B		ADDITIONAL TREATMENT COMPLETED. IN COMPLIANCE
DARLING AND CO.	MELVINDALE	RENDERING PRODUCTS	ROUGE RIVER	AERATED LAGOONS	640	282	1.13	SOLIDS + GREASE-A OXYGEN-A	5/13/66 3/26/66	IN COMPLIANCE
EVANS PRODUCTS CO.	PLYMOUTH	RAILROAD CARS AND VARIOUS METAL PRODUCTS	MIDDLE ROUGE RIVER	OIL SKIMMER	28.4	33.7	0.213	A	9/8/67	MAJORITY OF WASTES ARE DISCHARGED TO MUNICIPAL SYSTEM. IN COMPLIANCE.
FORD MOTOR CO. ENGINE & FOUNDRY DIVN. VALVE PLANT	NORTHVILLE	AUTOMOTIVE PARTS	MIDDLE ROUGE RIVER	NONE				A		COOLING WATER ONLY, INDUSTRIAL WASTES ARE DISCHARGED TO MUNICIPAL SYSTEMS.
FORD MOTOR CO. AUTO ASSEMBLY DIVN.	WAYNE	AUTOMOTIVE ASSEMBLY	LOWER ROUGE RIVER	SETTLING POND FOR PAINT WASTES		47	0.465	E		PROBLEM UNDER REVALUATION
FEDERAL MOGUL	NORTHVILLE	GEARS, BEARINGS AND OTHER METAL PRODUCTS	MIDDLE ROUGE RIVER	OIL COLLECTION	3.6	14.6	0.0875	A		
GENERAL MOTORS CORP., CHEVROLET MOTORS DIVN.		AUTOMOTIVE PARTS	MIDDLE ROUGE RIVER		--------NO DATA AVAILABLE----		--------	B		COOLING WATER ONLY, INDUSTRIAL WASTES ARE DISCHARGED TO MUNICIPAL SYSTEM
GENERAL MOTORS CORP., PARTS DISTRIBUTION CENTER	WAYNE	SERVICE	LOWER ROUGE RIVER	IMHOFF TANK AND TRICKLING FILTER	--------NO DATA AVAILABLE----		--------	A		SANITARY WASTES ONLY
MICHIGAN SEAMLESS TUBE CO., STANDARD TUBE DIVISION	REDFORD TWP.	METAL TUBES	LIVONIA DRAIN	OIL SKIMMERS AND LAGOON	24.9	149	0.745	B		

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 1	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
ROUGE VALLEY SEWAGE DISPOSAL SYSTEM DISTRICT (CONT'D)										
TOWNSEND STEEL PRODUCTS	PLYMOUTH	METAL PARTS	MIDDLE ROUGE RIVER	NONE	-------NO DATA AVAILABLE----------			E		CORRECTIVE PROGRAM UNDERWAY
TRILEX CORP.	CANTON TWP.	PLATED METAL PARTS	LOWER ROUGE RIVER	CHEMICAL RECLAMATION UNITS, OIL SKIMMER AND PONDS	0	35	0.28	E_C	11/30/67	BUILDING ADDITIONAL FACILITIES. PLAN CONNECTION TO CITY SEWERAGE SYSTEM
UNITED GREENFIELD CORP., WHITMAN AND BARNES DIVN.	PLYMOUTH	ROTARY TOOLS	MIDDLE ROUGE RIVER	NONE	5 (mg/l)	11 (mg/l)	5.0(gpm)			COOLING WATER ONLY
DOWN RIVER SEWAGE DISPOSAL SYSTEM DISTRICT										
BELLEVILLE PLATING COMPANY	BELLEVILLE	PLATED METAL PARTS	HURON RIVER	CHEMICAL TREATMENT AND SETTLING POND			0.02	A	5/28/58	IN COMPLIANCE
HURON VALLEY STEEL CORP.	BELLEVILLE	PIG IRON	HURON RIVER	SETTLING PONDS			1.1	B	6/27/62	NO LONGER DISCHARGES
DANA CORP.	ECORSE	AUTO AND TRUCK FRAMES & STEEL STRUCTURES	-------	NONE			0.58	B	7/26/50	TOXIC WASTES HAULED FROM PLANT
DETROIT EDISON	RIVER ROUGE	ELECTRICITY	-------	ASH LAGOONS			691.2	B		PRIMARILY COOLING WATER
DETROIT EDISON	WYANDOTTE	ELECTRICITY	-------	ASH LAGOONS	-------NO DATA AVAILABLE----------			E_C		CONSTRUCTION OF SETTLING BASINS COMPLETED MARCH, 1970
DETROIT EDISON	WYANDOTTE	ELECTRICITY (PENNSALT PLANT)	-------	NONE	-------NO DATA AVAILABLE----------			B		IN COMPLIANCE
GREAT LAKES STEEL CORP., BLAST FURNACE DIVN.	ECORSE	STEEL	-------	OIL SKIMMERS AND SETTLING BASINS		19,154	59.2	OIL-E_S SOLIDS -A ACID AND IRON - E_C	5/17/66 7/24/68 12/10/69	PARTIALLY IN COMPLIANCE. CORRECTIONS UNDERWAY TO REMOVE SOLUBLE OIL WASTE.
GREAT LAKES STEEL CORP., 80" HOT STRIP MILL	RIVER ROUGE	SHEET STEEL	-------	OIL SKIMMERS AND SETTLING BASINS	19,300		72.2	OIL-E SOLIDS-A	4/5/66	OIL LOSSES CORRECTED. NOW IN COMPLIANCE
GREAT LAKES STEEL	RIVER ROUGE	STEEL	-------	CLARIFIERS DEPHENOLIZER		64,170	67.0	OIL-D SOLIDS-E_P PHENOLS-A	5/13/66	ADDITIONAL TREATMENT FACILITIES UNDER CONSTRUCTION
PENNSALT CHEM. CORP., INDUSTRIAL DIVN. (EAST PLANT)	WYANDOTTE	CHEMICALS	-------	SOLIDS REMOVAL		19,010	60.0	B	4/5/66	IN COMPLIANCE
WYANDOTTE CHEMICALS CORP., NORTH WORKS	WYANDOTTE	CHEMICALS	-------	SETTLING PONDS, OIL SEPARATOR		141,000	56.0	A	5/17/66	IN COMPLIANCE
WYANDOTTE CHEMICALS CORP., SOUTH WORKS	WYANDOTTE	CHEMICALS	-------	SETTLING PONDS, OIL SKIMMERS		12,460	15.0	D	5/17/66	NOW IN COMPLIANCE

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 3	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMINATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
RIVERVIEW-TRENTON-GIBRALTAR-GROSSE ILE-DISTRICT										
PENNSALT CHEM. CORP., ORGANIC CHEMICALS DIVN. (WEST PLANT)	RIVERVIEW	CHEMICALS	VIA MONGUAGON DRAIN	LAGOONS OIL SKIMMERS		284.	6.8	B	4/5/66	IN COMPLIANCE
MONSANTO CO. PLASTICS PRODUCTS AND RESINS DIVN.	TRENTON	CHEMICALS	-------	NEUTRALIZATION, ACTIVATED SLUDGE	3,590	55	0.4	D_S	3/30/66	NOW IN COMPLIANCE
MONSANTO CO. INORGANIC CHEM. DIVN.	TRENTON	CHEMICALS	--------	PHOSPHOROUS REMOVAL, LAGOONS			9.52	B	5/13/66	GREATER THAN 80% PHOSPHOROUS REMOVAL BEING ACHIEVED BY THE COMPANY. IN COMPLIANCE
CHRYSLER CORP. AMPLEX DIVN.	TRENTON	PRESSED METAL GEARS AND PARTS	---------	SETTLING POND AND OIL SKIMMER	5	10	0.155	A		
CHRYSLER CORP. CHEM. PRODUCTS DIVN.	TRENTON	ADHESIVES BRAKE LININGS AND AUTO CHEMICALS	VIA MONGUAGON DRAIN	HOLDING POND	62.5	7.7	0.845	E_p	6/25/69	WILL CONNECT TO TRENTON SEWERAGE SYSTEM
CHRYSLER CORP., ENGINE PLANT	TRENTON	AUTOMOBILE ENGINES	VIA ELIZABETH PARK CANAL	AIR FLOTATION, OIL SKIMMER, CHEMICALCOAGULATION	447.	152	1.14	D_{SP}	2/23/66	HOLDING PONDS UNDER CONSTRUCTION. WASTES WILL BE PERIODICALLY HAULED AWAY.
DETROIT EDISON COMPANY	TRENTON	ELECTRICITY	---------	ASH LAGOONS			1,468	B	1/21/65	PRIMARILY COOLING WATER
FIRESTONE STEEL PRODUCTS CO.	RIVERVIEW	AUTOMOTIVE WHEELS AND PARTS	---------	OIL SEPARATOR PONDS		4,520	2,168	A	4/5/66	WASTE PICKLE LIQUOR HAULED FROM PLANT. IN COMPLIANCE.
McLOUTH STEEL CORP.	TRENTON	STEEL	---------	CHEMICAL COAGULATION, SETTING, NEUTRALIZATION, OIL SEPARATORS		15,152	65.7	A	4/5/66	IN COMPLIANCE
McLOUTH STEEL CORP.	GIBRALTAR	STEEL	VIA FRANK AND POET DRAIN	OIL SKIMMERS, LAGOONS, NEUTRALIZATION		218	1.64	D_p	8/29/63	PLANS APPROVED FOR ADDITIONAL TREATMENT FACILITIES.
LOWER HURON RIVER DISTRICT										
MONAHAN STEARNS SUBSIDIARY OF FEDERAL ENGINEERING	FLAT ROCK	ALUMINUM DOOR AND WINDOW FRAMES	HURON RIVER	ACID NEUTRALIZATION			0.076	E	10/10/67	UNDER REVALUATION

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 5	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
LOWER HURON RIVER DISTRICT (CONT'D)										
OTTAWA SILICA CO., MICHIGAN SILICA DIVN.	ROCKWOOD	SILICA	HURON RIVER	SETTLING PONDS			5.70	B		
D.T. & I. RAILROAD YARDS	FLAT ROCK	RAILROAD TERMINAL	SMITH CREEK	OIL SEPARATORS	--------NO DATA	AVAILABLE----------		IND-E_P SAN-E		PLAN TO CONNECT TO CITY SEWERAGE SYSTEM
MOBIL OIL CO.	WOODHAVEN	PETROLEUM	--------	OIL SEPARATOR, SETTLING PONDS		112	1.1	OIL B_C PHENOL-E	4/5/66	PROGRAM BEING DEVELOPED TO REDUCE PHENOL LOSSES

SOURCE: MICHIGAN WATER RESOURCE COMMISSION
MAY 1970

KEY TO CONTROL STATUS

A - CONTROL ADEQUATE

B - CONTROL PROVIDED - ADEQUACY NOT FULLY ESTABLISHED.

C - NO CONTROL - NEED NOT ESTABLISHED.

D - CONTROL PROVIDED - PROTECTION UNRELIABLE.

E - CONTROL INADEQUATE

c - CONSTRUCTION UNDERWAY

p - PLANS BEING PREPARED

s - STUDIES UNDERWAY

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 4	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
UPPER HURON R. DISTRICT										
CHRYSLER CORP. INTROL DIV.	SCIO	AUTOMOTIVE PARTS	HURON R.	CHEMICAL TREATMENT, SETTLING POND, TRICKLING FILTER	1.5	1.2		IND-A SAN-B	9/29/55	IN COMPLIANCE
FEDERAL SCREW WORKS	CHELSEA	STEEL PRODUCTS	LETTS CREEK	LEACH PITS	NO DATA AVAILABLE			E		UNDER REVALUATION
FORD MOTOR CO.	YPSILANTI	AUTOMOTIVE PARTS	HURON R.		NO DATA AVAILABLE			Bsc		FINAL DISCHARGE TO YPSILANTI S.T.P.
GENERAL MOTORS CORP. FISHER BODY DIV.	WILLOW RUN	AUTOMOTIVE PARTS	WILLOW CREEK	PRIMARY SETTLING AND SECONDARY LAGOON	800.0	128.0	0.640	TOXIC + BOD-Bc SOLID-Bc	5/23/63	FINAL DISCHARGE TO WAYNE COUNTY INTERCEPTOR
HOOVER BALL AND BEARING COMPANY	PITTSFIELD TWP	METAL BEARINGS	WOOD OUTLET DRAIN	TRICKLING FILTER			0.007	OIL-B SAN-A	2/28/57	IN COMPLIANCE
LONGWORTH PLATING CO.	CHELSEA	PLATED METAL	LETTS CREEK	CHEMICAL TREATMENT SETTLING TANKS		2.0	0.0104	B	2/18/65	UNDER EVALUATION
ROCKWELL STANDARD STEEL CORP., SPRING DIVISION	CHELSEA	STEEL SPRINGS	LETTS CREEK	OIL COLLECTION	NO DATA AVAILABLE			C		COOLING WATER ONLY
UNIVERSITY MICROFILMS	ANN ARBOR	PHOTO DEVELOPING	HONEY CREEK	AERATION TANKS	125	36		A	3/26/64	IN COMPLIANCE
HOOVER BALL AND BEARING CO.	MANCHESTER	PLATED METAL PARTS	RAISIN R.	CHEMICAL TREATMENT AND SETTLING PONDS	84	190	0.229	D	9/23/64	CORRECTIVE PROGRAM UNDERWAY.
HOOVER BALL AND BEARING CO., UNIVERSAL DIE CASTING DIV.	SALINE	CASTINGS AND PLATED METAL PARTS	SALINE R.	CHEMICAL TREATMENT AND SETTLING PONDS	79.8	202.5	0.460	Ec	5/16/68	ADDITIONAL TREATMENT FACILITIES UNDER CONSTRUCTION
HOOVER BALL AND BEARING CO., CHEMICAL PROD'S DIVISION	WHITMORE LAKE	CHEMICALS	HORSESHOE LAKE OUTLET DRAIN	NONE			0.108	A	7/24/58	IN COMPLIANCE
YPSILANTI STATE HOSPITAL			SALINE R.	TRICKLING FILTER	NO DATA AVAILABLE					WASTE TREATMENT NEEDS, INCLUDING POSPHORUS REMOVAL, ARE UNDER STUDY.
LOWER LIVINGSTON COUNTY DISTRICT										
NONE										

SOURCE: MICHIGAN WATER RESOURCES COMMISSION MAY 1970

KEY TO CONTROL STATUS

A - CONTROL ADEQUATE

B - CONTROL PROVIDED - ADEQUACY NOT FULLY ESTABLISHED.

C - NO CONTROL - NEED NOT ESTABLISHED.

D - CONTROL PROVIDED - PROTECTION UNRELIABLE.

E - CONTROL INADEQUATE

c - CONSTRUCTION UNDERWAY

p - PLANS BEING PREPARED

s - STUDIES UNDERWAY

INDUSTRIAL SURFACE WATER DISCHARGES

SUBAREA NO. 5	LOCATION	PRODUCT	RECEIVING STREAM	TREATMENT PROVIDED	AFTER TREATMENT			POLLUTION STATUS RATING (1969)	DATE OF ORDER OF DETERMIN-ATION-STIP.	REMARKS
					5 DAY BOD LBS/DAY	SUSPENDED SOLIDS LBS/DAY	FLOW MGD			
RAISIN RIVER DISTRICT										
* CONSOLIDATED PACK'G CORP., S. SIDE PLANT	MONROE	PAPER	RAISIN R.	CLARIFIERS, SCREENS	8,780	16,627	7.0	SOLIDS-E BOD-E	5/23/65	COMPANY WILL CONNECT TO MONROE SEWERAGE
* CONSOLIDATED PACK'G CORP., N. SIDE PLANT	MONROE	PAPER	RAISIN R.	CLARIFIERS, SCREENS	18,084	7,417	7.5	SOLIDS-E BOD-E	5/23/66	COMPANY WILL CONNECT TO MONROE SEWERAGE
* DUNDEE CEMENT CO.	DUNDEE	CEMENT	MACON CREEK	CHEMICAL AND SETTLING PONDS	328	2,400	3.93	B	9/23/58	IN COMPLIANCE
* FORD MOTOR CO	MONROE	AUTOMOTIVE PARTS	RAISIN R.	CHEMICAL TREATMENT AND SETTLING PONDS	---	---	124.0	PLATING-A SAN - B OIL - E	2/28/66	UNDER EVALUATION
* TIME CONTAINER CORP - MONROE DIV	MONROE	PAPER	RAISIN R.	CLARIFIERS	110	141	2.5	SOLIDS-E BOD-E	3/29/66	PLANS TO JOIN CITY OF MONROE SEWERAGE SYSTEM
* UNION CAMP CORP	MONROE	PAPER	RAISIN R.	CLARIFIERS	8,916	4,512	4.5	SOLIDS-E BOD-E	4/15/66+5/23/66	PLANS TO JOIN CITY OF MONROE SEWERAGE SYSTEM
* DETROIT EDISON CO. -ENRICO FERMI PLANT	FRENCHTOWN TWP, MONROE COUNTY	ELECTRICITY	SWAN CREEK	TRICKLING FILTER AND LAGOON	---	---	194.4	SAN-A	12/6/56	IN COMPLIANCE
UPPER RAISIN RIVER DISTRICT										
* BUCKEYE PRODUCTS	ADRIAN	PLATED PARTS	RAISIN R.	CHEMICAL TREATMENT		51.4	0.0073	E	1/27/54	COMPANY CEASED OPERATION AT THIS LOCATION
* CULLIGAN SOFT WATER SERVICES	ADRIAN	WATER SOFT-ENER SERVICE	S. BRANCH RAISIN R.	NONE	0.66	13.0	0.026		11/30/61	
* GRAY-FARADAY	ADRIAN	PLATED PARTS	RAISIN R.	CHEMICAL TREATMENT	0.8	14.0	0.03	D	7/26/62	UNDER REVALUATION
* HOME CANNING CO.	BLISSFIELD	CANNED TOMATOES AND OTHER VEGETABLES	RAISIN R.	LAGOON			0.150	B		
* SIMPLEX PAPER CO	PALMYRA	PAPER	RAISIN R.	SAVE-ALL	807	5,206	0.348	IND-B SAN-A	7/24/66	IN COMPLIANCE
* STAUFFER CHEMICAL COMPANY	TECUMSEH	ORGANIC COMPOUNDS	RAISIN R.	AERATION, SETTLING PONDS, ACTIVATED SLUDGE	23.7	87.8	0.079	A	2/26/64	IN COMPLIANCE
* STAUFFER CHEMICAL COMPANY	WESTON	ORGANIC COMPOUNDS	BLACK CREEK	AERATION, SETTLING PONDS, TRICKLING FILTER	345	164	0.229	Bc	6/27/62	IN COMPLIANCE
* TECUMSEH PRODUCTS COMPANY	TECUMSEH	REFRIGER-ATION UNITS	RAISIN R.	OIL SEPARATION AND ACID NEUTRALIZATION	470	1,475	0.55	Dp	5/16/69	PLAN TO CONNECT TO CITY SEWAGE SYSTEM
**TECUMSEH PRODUCTS COMPANY, PEERLESS GEAR AND MACHINERY DIVISION	CLINTON	MACHINE PRODUCTS	RAISIN R.	SMALL SETTLING PONDS			0.05	B		IN COMPLIANCE
FARADAY, INC	TECUMSEH	DICTATING EQUIPMENT: ELECTRO-CHEMICAL EQUIPMENT	RAISIN R.	CYANIDE TREATMENT		1.5	0.072	A	4/28/69	RECENT INSPECTION INDICATED POLLUTION PROBLEM AND NEED FOR FURTHER TREATMENT.

KEY TO CONTROL STATUS

A - CONTROL ADEQUATE

B - CONTROL PROVIDED - ADEQUACY NOT FULLY ESTABLISHED.

C - NO CONTROL - NEED NOT ESTABLISHED

D - CONTROL PROVIDED - PROTECTION UNRELIABLE

E - CONTROL INADEQUATE

c - CONSTRUCTION UNDERWAY s - STUDIES UNDERWAY

p - PLANS BEING PREPARED

* SOURCE: MICHIGAN WATER RESOURCES COMMISSION - MAY 1970

** SOURCE: MICHIGAN WATER RESOURCES COMMISSION AND MICHIGAN DEPARTMENT OF PUBLIC HEALTH-RELEASE - 1969